DELL™ POWEREDGE™ R610

TECHNICAL GUIDEBOOK

INSIDE THE POWEREDGE R610

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THE DELL™ POWEREDGE™ R610

Inspired by customer feedback, the Dell PowerEdge R610 server is engineered to simplify data center operations, improve energy efficiency, and lower total cost of ownership. System commonality, purposeful design, and service options combine to deliver a rack server solution that can help you better manage your enterprise.

Strong IT Foundation

The Dell PowerEdge R610 is a key building block for today's data center. Designed for versatility and high performance, it provides many of the virtualization, system management, and energy-efficiency features you need now and the scalability necessary to change as your business grows. This general-purpose Intel®-based 2-socket 1U server is ideal for corporate data centers and remote sites that require a dense, highly available single- or dual-processor server at an excellent value.

Enhanced Virtualization

Featuring Intel® Xeon®-based architecture, embedded hypervisors, expanded memory footprint, and I/O, the Dell PowerEdge R610 delivers exceptional overall system performance and significant virtual machine-per-server capacity versus the previous generation. With optional factory-integrated virtualization capabilities, you get tailored solutions – built with the latest technologies from Dell and our trusted partners – which allow you to streamline deployment and simplify virtual infrastructures. Choose your hypervisor from market leaders such as VMware®, Citrix®, and Microsoft®, and enable virtualization with a few mouse clicks.

Energy-Optimized Technologies

Dell's advanced thermal control helps optimize performance while minimizing system power consumption, ultimately driving energy efficiency across our latest core data center servers. These enhancements, over previous generations, include efficient power supply units right-sized for system requirements, improved system-level design efficiency, policy-driven power and thermal management, and highly efficient standards-based Energy Smart components. Dell's advanced thermal control is designed to deliver optimal performance at minimum system and fan power consumption resulting in our quietest mainstream 1U servers to date.

Purposeful Design

The R610 takes advantage of Dell's system commonality. Once your IT managers learn one system, they understand how to manage next-generation Dell servers. Logical component layout and power supply placement also provide a straightforward installation and redeployment experience.

Simplified Systems Management

Gain more control with the next-generation Dell OpenManage™ suite of management tools. These tools provide efficient operations and standards-based commands designed to integrate with existing systems.

Dell Management Console (DMC) helps simplify operations and create stability by shrinking infrastructure management to one console. This console delivers a single view and a common data source into the entire infrastructure management. Built on Symantec® Management Platform, it has an easily extensible, modular foundation that can provide basic hardware management all the way up to more advanced functions such as asset and security management. DMC is designed to reduce or eliminate manual processes enabling you to save time and money for more strategic technology usage.

Secure, efficient, and more user friendly than its predecessors, the Dell Unified Server Configurator (USC) delivers "Instant On" integrated manageability through a single access point. You get quick, persistent access to the tool because it is embedded and integrated into the system for increased flexibility and capabilities. The USC is a one-stop shop for deploying operating systems with built-in driver installations, firmware updates, hardware configuration, and issue diagnoses.

SECTION 1. SYSTEM OVERVIEW

A. Overview / Description

The PowerEdge R610 will lead Dell's 11th Generation PowerEdge portfolio in key areas of differentiation, primarily:

- Virtualization,
- Power, thermal, efficiency
- Systems management, and usability

B. Product Features Summary

FEATURE	DETAILS
Processor	Nehalem EP
Front Side Bus	Intel QuickPath Interconnect (QPI) @ maximum 6.GT/s
# Procs	2S
# Cores	4 cores
L2/L3 Cache	4MB and 8MB
Chipset	Tylersberg
DIMMs	RDIMM or UDIMM DDR3 (12 DIMMs – 6 per processor)
Min/Max RAM	1GB – 96GB
HD Bays	Internal hard drive bay and hot-plug backplane Up to six 2.5" SAS, SATA or SSD Drives
HD Types	SAS, SATA, Near-line SAS, and SSD
Ext Drive Bay(s)	External USB floppy. Optional SATA half-height optical drives such as DVD-ROM or DVD+RW.
Int. HD Controller	PERC 6i and SAS 6/iR
Optional HD Controller	PERC 5/E and PERC 6/E
BIOS	4MB flash for system BIOS, SAS, and Video BIOS
Video	Integrated Matrox G200, 8MB shared video memory
Availability	HP hard drives, HP power; memory SDDC, ECC, control line parity, optional redundant cooling.
Server Management	Dell Embedded Server Management provides IPMI 2.0 compliance.
I/O Slots	Two x8 Gen2 slots
RAID	PERC 6i utilizing battery backed 256MB DDRII 667
NIC/LOM	Broadcom 5809C (2 cards/4ports)
USB	Five USB ports (2 front, 2 rear, 1 internal)
Power Supplies	Two hot-plug high-efficient 502W PSU (Energy Smart) Two hot-plug 717W PSUs (High Output)
Front Control Panel	The system control panel is located on the front of the system chassis to provide user access to buttons, display, and I/O interfaces.
System ID	Front and Rear (0x0235)
Fans	Six Single processor configurations will only have five fans
Chassis	1U rackmount

SECTION 2. MECHANICAL

A. Chassis Description

The PowerEdge R610 is a 1U rackmount chassis. The updated design includes a new LCD, bezel and hard-drive carriers. Additional changes include tool-less rack latches, a pull out tray for customer labels, and LOM0/iDRAC MAC address; labels; support persistent storage (internal USB and SD card slots and external SD card slots); updated power supplies and removal process.

B. Dimensions and Weight

Height	4.26cm (1.68")
Width	48.24cm (18.99" – includes rack latches)
Depth	77.2cm (30.39" – includes bezel and power supply handles)
Weight (maximum config)	17.69kg (39lbs)

.

C. Front Panel View and Features

Front I/O panel access including USB and VGA interfaces. The following components are located on the front:

- System Identification panel (Information tag). A slide-out panel for system identification labels including the Express Service tag, embedded NIC MAC address and iDRAC6 Enterprise card MAC address. Space has been provided for an additional label.
- Power on indicator, power button
- NMI indicator (Nonmaskable interrupt). A device sends an NMI to signal the processor about hardware errors. It is used to troubleshoot software and device driver errors when using certain operating system
- (2) USB connectors. Connects USB devices to the system. The ports are USB 2.0 compliant
- Video connector
- LCD menu buttons. Allows you to navigate the control panel LCD menu
- LCD panel. Provides system ID, status information, and system error messages
- System identification button
- Optical drive (optional)
- Hard drives

D. Back Panel View and Features

The following components are located on the rear panel of the PowerEdge R610 enclosure:

- (1) 15-pin VGA connector
- (1) 9-pin serial port connector
- (4) Integrated 10/100/1000 Ethernet RJ-45 connectors
- (1) Rear system ID button
- (1) Active ID Cable Management Arm external LED jack
- (2) USB ports
- (1) (Optional) iDRAC6 Enterprise RJ-45 port
- (1) (Optional) iDRAC6 Express VFlash media slot
- (2) PCIe slots

E. Power Supply Indicators

The PSUs on the PowerEdge R610 have one status bi-color LED: green for AC power present and amber for a fault.

LED	POWER SUPPLY STATUS
	AC power is not present
	AC power is present
	Fault of any kind is detected
	DC power is applied to the system
←→	PSU mismatch (when hot-added/swapped)

F. NIC Indicators

INDICATOR	INDICATOR CODE
Link and activity indicators are off	The NIC is not connected to the network
Link indicator is green	The NIC is connected to a valid network link at 1000 Mbps
Link indicator is amber	The NIC is connected to a valid network link at 1000 Mbps
Activity indicator is green blinking	Network data is being sent or received

G. Side Views and Features

H. Rails and Cable Management

Rack installation components such as rails are provided with the PowerEdge R610 Rack Kit. The rack installation components are as follows: sliding rack mount with latest generation Cable Management Arm (CMA). The PowerEdge R610 will feature slam latches to offer easier removal from the rack. When the system is installed in a rack, please observe the following guideline:

When the system is installed in a rack, only Dell-approved CMAs should be installed behind the chassis.

Rails

- Enable the replacement of thumbscrews with slam latches on the chassis for easier stowing in the rack.
- Include the new, simple, and intuitive ReadyRail™ tool-less rack interface for square-hole and round-hole racks.
- Provide significantly improved compatibility with non-Dell racks.
- Static rails for the R610 & R710 fit in all types of four-post and two-post racks available in the industry including four-post threaded hole racks.

CMAs

- Provide much larger vent pattern for improved airflow through the CMA.
- Include a common support tray for eliminating CMA sag.
- Replaced tie wraps with hook and loop straps to eliminate risk of cable damage during cycling.
- Maintain key feature of being fully reversible with no conversion required.

I. Fans

Six dual-rotor 40mm fans are mounted in a fan assembly that is located in the chassis between the hard drive bay and the processors. Only five fans will be populated in systems with a single processor configuration. Each fan has a connector that plugs directly into the planar. (The PowerEdge R610 fans cannot be hot-swapped. There are six fan zones in the R610, with one zone for each system fan.) System fan speed is pulse-width modulated. Redundant cooling is supported with only one rotor failing at a time. The Embedded Server Management logic in the system will control and monitor the speed of the fans. A fan failure or over-temperature in the system will result in a notification from iDRAC6.

The PowerEdge R610 Power Supply Units do not have any integrated fans; they are cooled by the system fans in front of them. The system requires a PSU Close Out (metal cover) in place of the empty power supply slot. To provide cooling when the system is off, both rotors in FAN_MOD1 will run off of V_{aux} power at a low speed setting when the ambient air temperature in the PSU passes a pre-defined threshold. The iDRAC controls the fan in AutoCool mode.

J. Control Panel / LCD

The system control panel is located on the front of the system chassis to provide user access to buttons, display, and I/O interfaces. Features of the system control panel include:

- ACPI-compliant power button with an integrated green power LED (controlled by iDRAC6)
- 128x20 pixel LCD panel with controls
    - Two navigation buttons
    - One select button
    - One system ID button
- Non-Maskable Interrupt (NMI) button (recessed)
- Ambient temperature sensor
- Two external USB 2.0 connectors (with an internal USB connector and Internal SD Module)
- 15-pin VGA connector

The LCD panel is a graphics display controlled by iDRAC6, unlike the 9G panel which had its own CPLD. Error codes can be sent to the display by either iDRAC6 or BIOS.

The LCD panel is a graphics display controlled by the BMC/ESM. Both ESM and BIOS can send error codes and messages to the display.

The system's LCD panel provides system information and status messages to signify when the system is operating correctly or when the system needs attention.

The LCD backlight lights blue during normal operating conditions and lights amber to indicate an error condition. When the system is in standby mode, the LCD backlight is off and can be turned on by pressing the Select button on the LCD panel. The LCD backlight will remain off if the "No Message" option is selected through the iDRAC6, the LCD panel, or other tools.

BIOS has the ability to enter a “Secure Mode” through Setup, which locks the power and NMI buttons. When in this mode, pressing either button has no effect but does not mask other sources of NMI and power control.

K. Security

I. Cover Latch

A tooled entry latch is provided on the top of the unit to secure the top cover to the chassis.

II. Bezel

A metal bezel is mounted to the chassis front to provide the Dell ID. A lock on the bezel is used to protect un-authorized access to system peripherals and the control panel. System status via the LCD is viewable even when the bezel is installed.

III. Hard Drive

The optional front bezel of the system contains a lock. A locked bezel secures the system hard drives.

IV. TPM

The TPM is used to generate/store keys, protect/authenticate passwords, and create/store digital certificates. TPM can also be used to enable the BitLocker™ hard drive encryption feature in Windows Server® 2008. TPM is enabled through a BIOS option and uses HMAC-SHA1-160 for binding. There will be different planar PWA part numbers to accommodate the different TPM solutions. The “Rest of World” (ROW) version will have the TPM soldered onto the planar. The other version of the planar (post RTS and primarily for use by China) will have a connector for a plug-in module.

V. Power Off Security

The control panel is designed such that the power switch cannot be accidentally activated. The lock on the bezel secures the switch behind the bezel. In addition, there is a setting in the CMOS setup that disables the power button function.

VI. Intrusion Alert

A switch mounted on the left riser board is used to detect chassis intrusion. When the cover is opened, the switch circuit closes to indicate intrusion to ESM. When enabled, the software can provide notification to the customer that the cover has been opened.

VII. Secure Mode

BIOS has the ability to enter a secure boot mode via Setup. This mode includes the option to lock out the power and NMI switches on the Control Panel or set up a system password. See the Whoville BIOS Specification for details

L. USB Key

The port on the control panel is for an optional USB key and is located inside the chassis. Some of the possible applications of the USB key are:

- User custom boot and pre-boot OS for ease of deployment or diskless environments
- USB license keys for software applications like eToken™ or Sentinel Hardware Keys
- Storage of custom logs or scratch pad for portable user-defined information (not hot-swappable)

M. Battery

A replaceable coin cell CR2032 3V battery is mounted on the planar to provide backup power for the Real-Time Clock and CMOS RAM on the ICH9.

N. Field Replaceable Units (FRU)

The planar contains a serial EEPROM to contain FRU information including Dell part number, part revision level, and serial number. iDRAC6 Enterprise (previously referred to as Advanced Management Enablement Adapter - AMEA) also contains a FRU EEPROM. The backplane's SEP and the power supplies' microcontroller are also used to store FRU data.

SECTION 3. ELECTRICAL

A. Volatility

See Appendix A of this Technical Guidebook.

B. ePPID (Electronic Piece Part Identification)

ePPID is an electronic repository for information from the PPID label that is stored in non-volatile RAM. The BIOS reports the ePPID information using SMBIOS data structures. ePPID includes the following information:

- Dell part number
- Part revision level
- Country of origin
- Supplier ID code
- Date code (date of manufacture)
- Unique sequence number

COMPONENT	DESCRIPTION	STORAGE LOCATION
BOARDS		
Planar	PWA,PLN,SV,DELL,R610	iDRAC FRU
2.5" Backplane	PWA,BKPLN,SV,R610,2.5SASX6	SEP
POWER SUPPLIES		
717W High Output PSU	PWR SPLY,717W,RDNT,ASTEC	PSU Microcontroller
	PWR SPLY,717W,RDNT,DELTA	PSU Microcontroller
502W Energy Smart PSU	PWR SPLY,502W,RDNT,ASTEC	PSU Microcontroller
	PWR SPLY,502W,RDNT,COLDWATT	PSU Microcontroller
STORAGE CARDS		
PERC 6/i Integrated	ASSY, CRD, PERC6I-INT, SAS, NOSLED	FRU
PERC 6/E External	PWA, CTL, PCIE, SAS, PERC6/E,ADPT	FRU
SAS 6/iR Integrated	PWA, CTL, SAS, SAS6/IR, INTG	FRU

Table: ePPID Support list

SECTION 4. POWER, THERMAL, ACOUSTIC

A. Power Efficiencies

One of the main features of the 11th generation of PowerEdge servers is enhanced power efficiency. The R610 achieves higher power efficiency by implementing the following features:

- User-selectable power cap (subsystems will throttle to maintain the specified power cap)
- Improved power budgeting
- Accurate inlet temperature
- PSU / VR efficiency improvements
- Switching regulators instead of linear regulators
- Closed loop thermal throttling
- PWM fans with an increased number of fan zones and configuration-dependent fan speeds
- Increased rear venting / 3D venting
- Use of DDR3 memory (lower voltage compared to DDR2, UDIMM support)
- CPU VR dynamic phase shedding
- Memory VR static phase shedding
- Random time interval for system start
- Allows an entire rack to power on without exceeding the available power
- BIOS Power/Performance options page
- Active Power Controller (BIOS-based CPU P-state manager)
- Ability to power down or throttle memory
- Ability to disable a CPU core
- Ability to turn off LOMs or PCIe lanes when not being used
- Option to run PCIe at Gen1 speeds instead of Gen2

B. Power Supplies

I. Main Power Supply

The base redundant system consists of two hot-swap 502W Energy Smart power supplies in a 1+1 configuration. A 717W high-output power supply is also available. The power supplies connect directly to the planar. There is a power cable to connect between the planar and the backplane. The R610 power supplies do not have embedded cooling fans; the PSUs are cooled only by the system cooling fans. The three status LEDs on the PSU have been replaced with a single bi-color LED starting with the PT build.

Starting with the 11th generation of PowerEdge servers (R710, R610, T610, M610, and M710), the power supplies no longer have a FRU EEPROM. FRU data is now stored in the memory of the PSU Microcontroller. Additionally, the PSU Firmware can now be updated by the BMC over the PMBus. Power is “soft-switched,” allowing power cycling via a switch on the front of the system enclosure, or via software control (through server management functions).

If using only one power supply, the single PSU should be installed in the PS1 bay and a PSU Close Out (metal cover) will be installed in the PS2 bay. The use of the PS1 bay for the single PSU configuration is done for consistency only – there is nothing that prevents the use of the PS2 bay in a single PSU configuration.

C. Power Supply Specifications

AC POWER SUPPLY (PER POWER SUPPLY)	
Wattage	717 Watt (High Output) 570 Watt (Energy Smart)
Voltage	90-264 VAC, autoranging, 47-63Hz
Heat Dissipation	2446.5 BTU/hr maximum (High Output) 1712.9 BTU/hr maximum (Energy Smart)
Maximum Inrush Current	Under typical line conditions and over the entire system ambient operating range, the inrush current may reach 55A per power supply for 10ms or less.

D. Environmental Specifications

TEMPERATURE	
Operating	10° to 35°C (50° to 95°F) with a maximum temperature gradation of 10°C per hour Note: For altitudes above 2950 feet, the maximum operating temperature is de-rated 1°F/550 ft
Storage	-40° to 65°C (-40° to 149°F) with a maximum temperature gradation of 20°C per hour
RELATIVE HUMIDITY	
Operating	20% to 80% (non-condensing) with a maximum humidity gradation of 10% per hour
Storage	5% to 95% (non-condensing) with a maximum humidity gradation of 10% per hour

MAXIMUM VIBRATION	
Operating	0.26 Grms at 5 – 350Hz for 5 minutes in operational orientations
Storage	1.54 Grms at 10 – 250Hz for 10 minutes in all orientations
MAXIMUM SHOCK	
Operating	Half sine shock in all operational orientations of 31G 5% with a pulse duration of 2.6 ms 10%
Storage	Half sine shock on all six sides of 71G 5% with a pulse duration of 2 ms 10% Square wave shock on all six sides of 27G with velocity change @ 235 in/sec or greater
ALTITUDE	
Operating	-16 to 3048 m (-50 to 10,000 ft) Note: For altitudes above 2950 feet, the maximum operating temperature is de-rated 1°F/550 ft
Storage	-16 to 10,600 m (-50 to 35,000 ft)

E. Power Consumption Testing

FEATURE	ENERGY SMART PSU	HIGH OUTPUT PSU
Dimensions	L-249 mm[1] x W-65.5 mm x H-38.2 mm	
Status Indicators	1 x bi-color Light Emitting Diode	
Integrated Fans	None	
Fixed Input Plug	IEC-C14	
AC Cord Rating	15 Amps @ 120 VAC, 10 Amps @ 240 VAC	
Input Voltage	90 – 264 VAC	
Auto-ranging	Yes	
Line Frequency	47 – 63 Hertz	
Maximum Inrush Current	55 Amps per supply for 10 ms or less	
Hot-Swap Capability	Yes	
Output Power	502 Watts	717 Watts
Maximum Heat Dissipation	1712.9 BTU per hour	2446.5 BTU per hour
Efficiency (20% - 100% Load)	86.5 - 90% @ 115 VAC 88 - 92% @ 230 VAC	85 – 88.5% @ 115 VAC 86.5 – 90.5% @ 230 VAC

F. Maximum Input Amps

Max input current (High Output): 10.5A @ 90 VAC, 5.3A @ 180 VAC

Max input current (EnergySmart): 7.0A @ 90 VAC, 3.5A @ 180 VAC

G. EnergySMART Enablement

The 11G family implements aspects of Dell's new Energy Smart strategy.
Major differences include:

- Discontinuing Energy Smart-branded servers with limited configurations and instead offering Energy Smart components on a portfolio level, such as high capacity and Energy Smart power supplies
- Allowing customers to order either a lowest power footprint configuration or a best performance-per-watt configuration
- Offering Energy Smart selected components such as DIMMs or hard drives, but not "cherry picking" or screening individual manufacturers' components based on energy consumption.

H. Acoustics

The acoustical design of the PowerEdge R610 reflects the following:

- Adherence to Dell's high sound-quality standards. Sound quality is different from sound power level and sound pressure level in that it describes how humans respond to annoyances in sound, like whistles, hums, etc. One of the sound quality metrics in the Dell specification is prominence ratio of a tone, and this is listed in the table below.
- Office environment acoustics. Compare the values for LpA in the table below and note that they are lower than ambient noise levels of typical office environments.
- Hardware configurations affect system noise levels. Dell's advanced thermal control provides for optimized cooling with varying hardware configurations. Most typical configurations will perform as listed in the table below. However some less typical configurations and components can result in higher noise levels, for example, a system configured with a PERC6/E card (noted in table below). (Please note that dBA values are not additive.)
- Noise ramp and descent at bootup.
    - Fan speeds, hence noise levels, ramp during the boot process in order to add a layer of protection for component cooling in the case that the system were not to boot properly.
    - The power supplies are passive in the R610, that is, they contain no internal fans. After power is connected to the power supplies, initialization of power supply communication with the server's fan control firmware takes place and assesses if cooling is required in standby mode. It is therefore normal for chassis fan #1 to operate at full speed for approximately 30 seconds after power is connected to the system. The fan will ramp down to a full stop after this time period in $\leq$ 25° C ambient conditions.

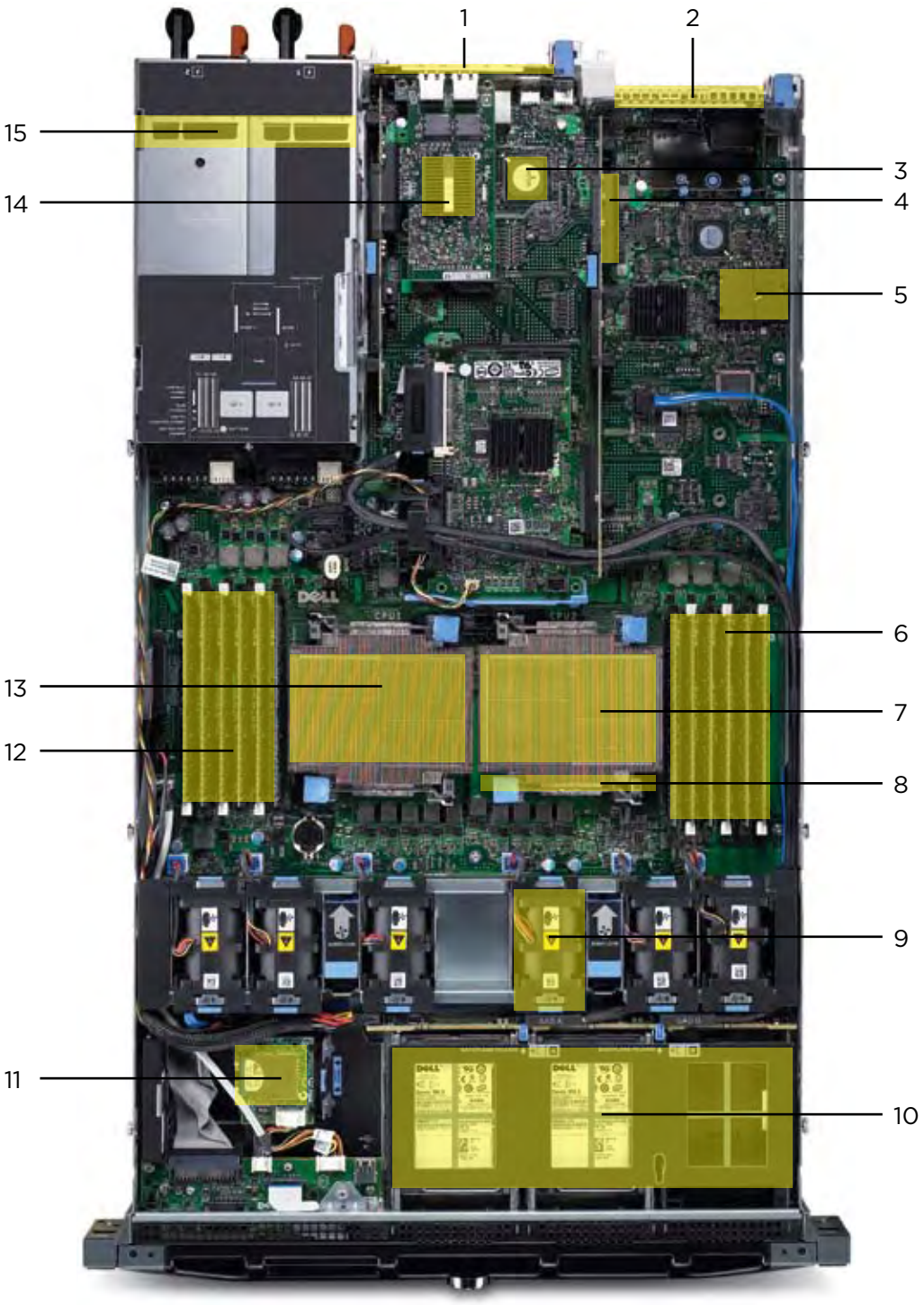
PowerEdge R610 with GY134 fans (quantity below), 2x 502-W KY091 Power Supplies, 2.40 GHz Quad-Core E5530 CPUs (quantity below), 2-GB DIMMs (quantity below), 1x DVD Drive, Perc 6i card, and 4x XK112 Hard Disk Drives			
2x CPUs, 6x fans, 8x DIMMs			
Condition in 23±2° C ambient	LwA-UL, bels	LpA, dBA	Tones
Standby	1.8	16	No prominent tones
Idle	5.3	35	No prominent tones
Active Hard Disk Drives	5.4	37	No prominent tones
Stressed Processor	5.3	35	No prominent tones
1x CPU, 5x fans, 4x DIMMs			
Idle	5.2	34	No prominent tones
Active Hard Disk Drives	5.4	37	No prominent tones
Stressed Processor	5.2	34	No prominent tones
2x CPU plus a PERC6/E external RAID controller	6.0	44	No prominent tones

Definitions
Standby: AC Power is connected to power supply units but system is not turned on.
Idle: Reference ISO7779 (1999) definition 3.1.7; system is running in its OS but no other specific activity.
Active Hard Drives: An operating mode per ISO7779 (1999) definition 3.1.6; Section C.9 of ECMA-74 9th ed. (2005) is followed in exercising the hard disk drives.
Stressed Processor: An operating mode per ISO7779 (1999) definition 3.1.6; SPECPower set to 50% loading is used.
LwA-UL: The upper limit sound power level (LwA) calculated per section 4.4.2 of ISO 9296 (1988) and measured in accordance with ISO7779 (1999).
LpA: The average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO9296 (1988) and measured in accordance with ISO7779 (1999). The system is placed in a rack with its bottom at 25 cm from the floor.
Tones: Criteria of D.5 and D.8 of ECMA-74 9th ed. (2005) are followed to determine if discrete tones are prominent. The system is placed in a rack with its bottom at 75 cm from the floor. The acoustic transducer is at front bystander position, ref ISO7779 (1999), Section 8.6.2.

SECTION 5. BLOCK DIAGRAM

The PowerEdge R610 electrical system consists of the planar subsystem with TPM, iDRAC6 Enterprise, iSCSI key, PCIe risers, power supply subsystem, system control panel, backplane, and storage (PERC 6/i or SAS 6/iR) card. The features and functions of these electrical subsystems are detailed below.

The R610 motherboard is an internal Dell-designed board that contains the processor electronics, memory, and most key processor functions on a single planar.



1. Embedded Network Interface Ports (4)
2. iDRAC6 Enterprise (Optional)
3. Broadcom 5709c Network Interface controller (second controller under PCI card)
4. PCIe Gen2 Riser / Slots
5. iDRAC6 Express / Lifecycle Controller
6. DIMM Slots
7. Heat Sink / Processor Socket
8. R610
9. Redundant fans
10. Hard drive bay
11. Internal SD Module (Embedded Hypervisor Optional)
12. DIMM Slots
13. Heat Sink / Processor Socket
14. PCIe Gen2 Riser / Slots
15. Dual Redundant Power Supplies

SECTION 6. PROCESSORS

A. Overview / Description

The Intel® 5500 series 2S processor (Nehalem - Efficient Processor (EP)), is the microprocessor designed specifically for servers and workstation applications. The processor features quad-core processing to maximize performance and performance/watt for data center infrastructures and highly dense deployments. The Nehalem-EP 2S processor also features Intel's Core™ micro-architecture and Intel 64 architecture for flexibility in 64-bit and 32-bit applications and operating systems.

The 5500 series 2S processor (Nehalem EP) utilizes a 1366-contact Flip-Chip Land Grid Array (FC-LGA) package that plugs into a surface mount socket. PowerEdge R610 provides support for up to two 5500 series 2S processors (Nehalem EP).

NEHALEM-EP 2S PROCESSOR	FEATURES
Cache Size	32KB instruction, 32KB data, 4 or 8MB (shared)
Multi-processor Support	1-2 CPUs
Package	LGA1366

Table: Nehalem-EP Features

B. Features

Key features of the 5500 series 2S processor (Nehalem EP) include:

- Four or two cores per processor
- Two point-to-point QuickPath Interconnect links at up to 6.4 GT/s
- 1366-pin FC-LGA package
- 45 nm process technology
- No termination required for non-populated CPUs (must populate CPU socket 1 first)
- Integrated three-channel DDR3 memory controller at up to 1333MHz
- Compatible with existing x86 code base
- MMX™ support
    - Execute Disable Bit Intel Wide Dynamic Execution
- Executes up to four instructions per clock cycle
- Simultaneous Multi-Threading (Hyper-Threading) capability
- Support for CPU Turbo Mode (on certain SKUs)
    - Increases CPU frequency if operating below thermal, power, and current limits
- Streaming SIMD (Single Instruction, Multiple Data) Extensions 2, 3, and 4
- Intel 64 Tecnology for Virtualization
- Intel VT-x and VT-d Technology for Virtualization
- Demand-based switching for active CPU power management as well as support for ACPI P-States, C-States, and T-States

C. Supported Processors

MODEL	SPEED	POWER	CACHE	CORES
X5570	2.93GHz	95W	8M	4
X5560	2.80GHz	95W	8M	4
X5550	2.66GHz	95W	8M	4
E5540	2.53GHz	80W	8M	4
E5530	2.40GHz	80W	8M	4
E5520	2.26GHz	80W	8M	4
L5520	2.26GHz	60W	8M	4
E5506	2.13GHz	80W	4M	4
L5506	2.13GHz	60W	4M	4
E5504	2.00GHz	80W	4M	4
E5502	1.86GHz	80W	4M	2

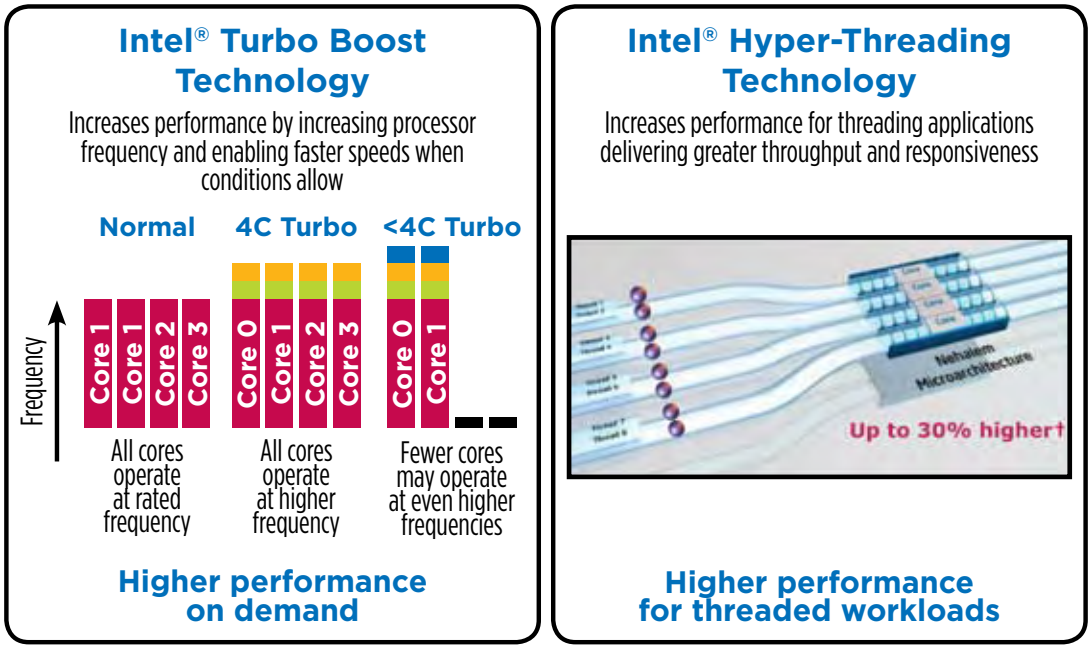
D. Processor Configurations

Single CPU Configuration

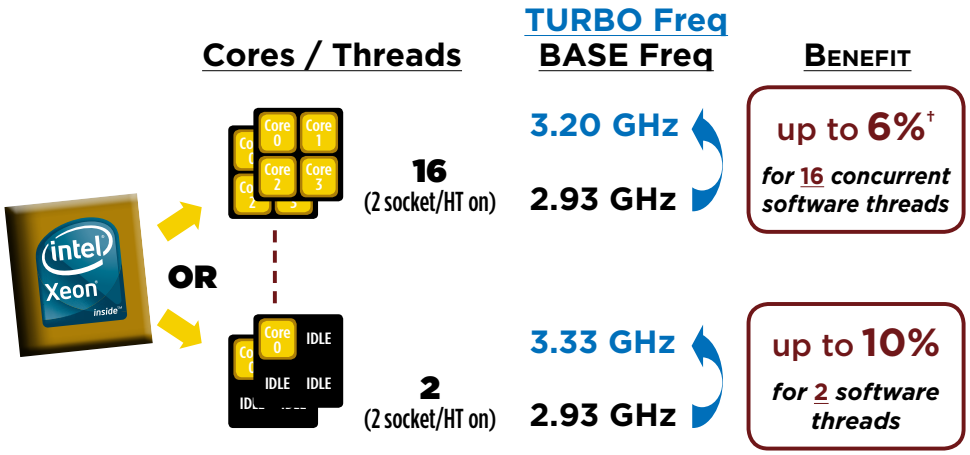
The PowerEdge R610 is designed such that a single processor placed in the CPU1 socket will function normally, however PowerEdge R610 systems require a CPU blank in the CPU2 socket for thermal reasons. The system will be held in reset if a single processor is placed in the CPU2 socket.

Performance Enhancements

Intel Xeon® 5500 Series Processor (Nehalem-EP)



Intel® Turbo Boost Technology



MODEL	SPEED	POWER	CACHE	CORES
X5570	2.93GHz	95W	8M	4
X5560	2.80GHz	95W	8M	4
X5550	2.66GHz	95W	8M	4
E5540	2.53GHz	80W	8M	4
E5530	2.40GHz	80W	8M	4
E5520	2.26GHz	80W	8M	4
L5520	2.26GHz	60W	8M	4
E5506	2.13GHz	80W	4M	4
L5506	2.13GHz	60W	4M	4
E5504	2.00GHz	80W	4M	4
E5502	1.86GHz	80W	4M	2

CPU Power Voltage Regulation Modules (EVRD 11.1)
Voltage regulation to the 5500 series 2S processor (Nehalem EP) is provided by EVRD (Enterprise Voltage Regulator-Down). EVRDs are embedded on the planar. CPU core voltage is not shared between processors. EVRDs support static phase shedding and power management via the PMBus.

SECTION 7. MEMORY

A. Overview / Description

The PowerEdge R610 utilizes DDR3 memory providing a high performance, high-speed memory interface capable of low latency response and high throughput. The PowerEdge R610 supports Registered ECC DDR3 DIMMs (RDIMM) or Unbuffered ECC DDR3 DIMMs (UDIMM).

The system contains 12 memory sockets split into two sets of six sockets, one set per processor. Each six-socket set is organized into three channels of two memory sockets per channel.

Key features of the PowerEdge R610 memory system include:

- Registered (RDIMM) and Unbuffered (UDIMM) ECC DDR3 technology
- Each channel carries 64 data and eight ECC bits
- Support for up to 96GB of RDIMM memory (with twelve 8GB RDIMMs)
- Support for up to 24GB of UDIMM memory (with twelve 2GB UDIMMs)
- Support for 1066/1333MHz single- and dual-rank DIMMs
- Support for 1066MHz quad-rank DIMMs
- Single DIMM configuration only with DIMM in socket A1
- Support ODT (On Die Termination) Clock gating (CKE) to conserve power when DIMMs are not accessed
    - DIMMs enter a low power self-refresh mode
- I2C access to SPD EEPROM for access to RDIMM thermal sensors
- Single Bit Error Correction
- SDDC (Single Device Data Correction – x4 or x8 devices)
- Support for Closed Loop
- Thermal Management on RDIMMs and UDIMMs
- Multi Bit Error Detection Support for Memory Optimized Mode
- Support for Advanced ECC mode Support for Memory Mirroring

B. DIMMs Supported

The DDR3 memory interface consists of three channels, with up to two RDIMMs or UDIMMs per channel for single-/dual-rank and up to two RDIMMs per channel for quad rank. The interface uses 2GB, 4GB, or 8GB RDIMMs. 1GB or 2GB UDIMMs are also supported. The memory mode is dependent on how the memory is populated in the system:

Three channels per CPU populated identically.
In a dual-processor configuration, the memory configurations for each processor must be identical

- Typically, the system will be set to run in Memory Optimized (Independent Channel) mode in this configuration. This mode offers the most DIMM population flexibility and system memory capacity, but offers the least number of RAS (reliability, availability, service) features.
    - Memory modules are installed in numeric order for the sockets beginning with A1 or B1
- All three channels must be populated identically.
- The first two channels per CPU populated identically with the third channel unused
    - Typically, two channels operate in Advanced ECC (Lockstep) mode with each other by having the cache line split across both channels. This mode provides improved RAS features (SDDC support for x8-based memory).
    - For Memory Mirroring, two channels operate as mirrors of each other — writes go to both channels and reads alternate between the two channels.
- For Memory Mirroring or Advanced ECC Mode, the three sockets furthest from the processor are unused and memory modules are installed beginning with socket A2 or B2 and proceeding in the following order: A2, A3, A5, and A6
- One channel per CPU populated
- This is a simple Memory Optimized mode. Mirroring is not supported.

The PowerEdge R610 memory interface supports memory demand and patrol scrubbing, single-bit correction and multi-bit error detection. Correction of a x4 or x8 device failure is also possible with SDDC in the Advanced ECC mode. Additionally, correction of a x4 device failure is possible in the Memory Optimized mode.

- If DIMMs of different speeds are mixed, all channels will operate at the fastest common frequency.
- RDIMMs and UDIMMs cannot be mixed.
- If memory mirroring is enabled, identical DIMMs must be installed in the same slots across both channels. The third channel of each processor is unavailable for memory mirroring.
- The first DIMM slot in each channel is color-coded with white ejection tabs for ease of installation.

- The DIMM sockets are placed 450 mils (11.43 mm) apart, center-to-center in order to provide enough space for sufficient airflow to cool stacked DIMMs.
- The PowerEdge R610 supports up to 12 DIMMs. DIMMs must be installed in each channel starting with the DIMM slot farthest from the processor. Population order will be identified by the silkscreen designator and the System Information Label (SIL) located on the chassis cover.
    - Memory Optimized: {1, 2, 3}, {4, 5, 6}
    - Advanced ECC or Mirrored: {2, 3}, {5, 6}
    - Quad Rank or UDIMM: {1, 2, 3}, {4, 5, 6}

C. Speed

Memory Speed Limitations

The memory frequency is determined by a variety of inputs:

- Speed of the DIMMs
- Speed supported by the CPU
- Configuration of the DIMMs

The memory speed of each channel depends on the memory configuration:

- For single- or dual-rank memory modules:
    - One memory module per channel supports up to 1333MHz
    - Two memory modules per channel supports up to 1066MHz
    - Three memory modules per channel are limited to 800MHz regardless of the memory module speed.
- For quad-rank memory modules:
    - One memory module per channel supports up to 1066Mhz
    - Two memory modules per channel are limited to 800MHz, regardless of memory module speed

If memory modules with different speeds are installed, they will operate at the speed of the slowest installed memory module(s).

The table below shows the memory populations and the maximum frequency achievable for that configuration.

DIMM TYPE	DIMM 0	DIMM 1	DIMM 2	NUMBER OF DIMMS	800	1066	1333
UDIMM	SR			1			
	DR			1			
	SR	SR		2			
	SR	DR		2			
	DR	DR		2			
RDIMM	SR			1			
	DR			1			
	QR			1			
	SR	SR		2			
	SR	DR		2			
	DR	DR		2			
	QR	SR		2			
	QR	DR		2			
	QR	QR		2			
	SR	SR	SR	3			
	SR	SR	DR	3			
	SR	DR	DR	3			
	DR	DR	DR	3			

Note: For QR mixed with a SR/DR DIMM, the QR needs to be in the white DIMM connector. There is no requirement in the order of SR and DR DIMMs.

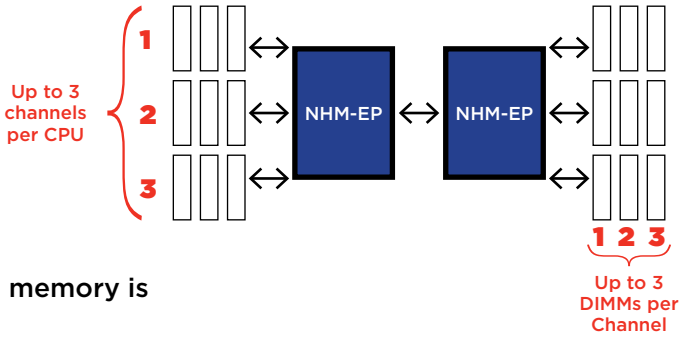
Supported

Not Supported

NOTE: For Quad Rank DIMMs mixed with single- or dual-rank DIMMs, the QR DIMM needs to be in the slot with the white ejection tabs (the first DIMM slot in each channel). There is no requirement for the order of SR and DR DIMMs

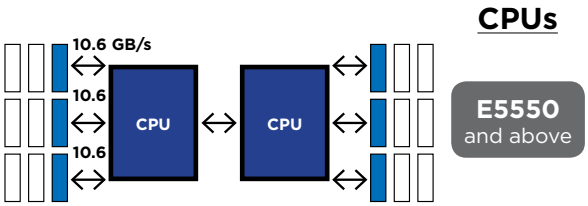
NHM-EP Platform Memory Overview

- Platform capability (18 DIMMs):
  - Up to 3 channels per CPU
  - Up to 3 DIMMS per channel
- Memory Types Supported:
  - DDR 1333, 1066, and 800
  - Registered (RDIMM) and unbuffered (UDIMM)
  - Single-rank (SR), dual-rank (DR), quad-rank (QR)
- System memory Speed (i.e. the speed at which the memory is *actually* running) is set by BIOS depending on:
  - CPU capability
  - DIMM type(s) used (memory speed, U/RDIMM, SR/DR/QR)
  - DIMM populated per channel
- All channels in a system will run at the fastest *common* frequency

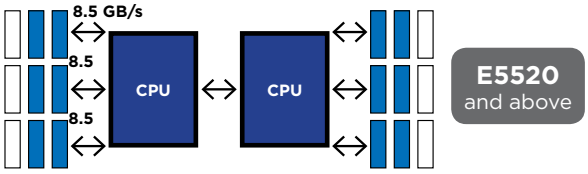


Memory Population Scenarios

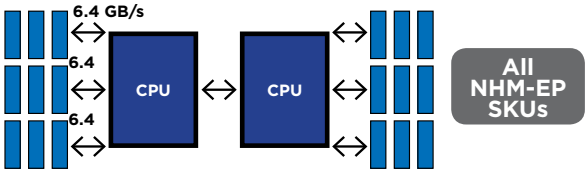
- **Maximum B/W:**
  - DDR3 1333 across 3 channels
  - 1 DPC (6 DIMMs)
  - Max capacity: 48 GB+



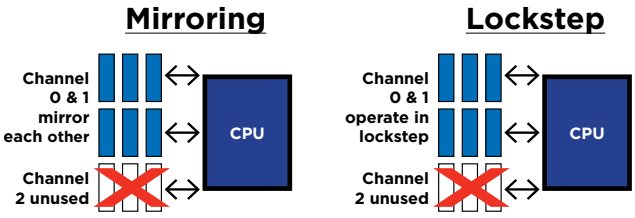
- **Balanced Performance:**
  - DDR3 1066 across 3 channels
  - Up to 2 DIMMs per Channel (DPC) (12 DIMMs)
  - Max capacity: 96 GB+



- **Maximum capacity:**
  - DDR3 800 across 3 channels
  - Up to 3 DPC (18 DIMMs total)
  - Max capacity: 144 GB+



- **RAS capabilities:**



D. Supported Configurations

MEMORY MODE	MEMORY MODULE SIZE	MEMORY SOCKETS						SINGLE PROCESSOR		DUAL PROCESSOR	
		1		2		3		PHYSICAL MEMORY (GB)	AVAILABLE MEMORY (GB)	PHYSICAL MEMORY (GB)	AVAILABLE MEMORY (GB)
			4		5		6				
OPTIMIZER	2GB	x						2	All	4	All
		x		x				4		8	
		x		x		x	x	6		12	
		x	x					4		8	
		x	x	x	x			8		16	
		x	x	x	x	x	x	12		24	
	4GB	x						4	All	8	All
		x		x				8		16	
		x		x		x	x	12		24	
		x	x					8		16	
		x	x	x	x			16		32	
		x	x	x	x	x	x	24		48	
	8GB[a]	x						8	All	16	All
		x		x				16		32	
		x		x		x	x	24		48	
		x	x					16		32	
		x	x	x	x			32		64	
		x	x	x	x	x	x	48		96	
ADVANCED ECC[b] OR MIRRORING	2GB	None		x		x		4	2	8	4
				x	x	x	x	8	4	16	8
	4GB	None		x		x		8	4	16	8
				x	x	x	x	16	8	32	16
	8GB	None		x		x		16	8	32	16
				x	x	x	x	32	16	64	32

Table: RDIMM Memory Configurations (Each Processor)

[a] When available
[b] Requires x4- or x8-based memory modules

MEMORY MODE	MEMORY MODULE SIZE	MEMORY SOCKETS						SINGLE PROCESSOR		DUAL PROCESSOR	
		1		2		3		PHYSICAL MEMORY (GB)	AVAILABLE MEMORY (GB)	PHYSICAL MEMORY (GB)	AVAILABLE MEMORY (GB)
			4		5		6				
OPTIMIZER	1GB	x						1	All	2	All
		x		x				2		4	
		x		x		x		3		6	
		x	x	x	x			4		8	
		x	x	x	x	x	x	6		12	
	2GB	x						2	All	4	All
		x		x				4		8	
		x		x		x		6		12	
		x	x	x	x			8		16	
		x	x	x	x	x	x	12		24	
ADVANCED ECC[b]	1GB	None		x		x		2	All	All	All
				x	x	x	x	4			
	2GB	None		x		x		4	All	All	All
				x	x	x	x	8			
MIRRORING	1GB	None		x		x		2	1	4	2
				x	x	x	x	4	2	8	4
	2GB	None		x		x		4	2	8	4
				x	x	x	x	8	4	16	8

Table: UDIMM Memory Configurations (Each Processor)

[a] Requires x4- or x8-based memory modules

E. Slots / Risers

PowerEdge R610 has 12 DIMM slots for memory. It does not have any riser cards for DIMM population.

F. Mirroring

PowerEdge R610 supports memory sparing in certain configurations, refer to embedded memory matrix spreadsheet in section 10-H for supported configurations.

The system supports memory mirroring if identical memory modules are installed in the two channels closest to the processor (memory is not installed in the farthest channel [channel 2]. Mirroring must be enabled in the System Setup program. In a mirrored configuration, the total available system memory is one-half of the total installed physical memory.

G. Advanced ECC (Lockstep) Mode

In this configuration, the two channels closest to the processor are combined to form one 128-bit channel. This mode supports Single Device Data Correction (SDDC) for both x4- and x8-based memory modules. Memory modules must be identical in size, speed, and technology in corresponding slots.

H. Optimizer (Independent Channel) Mode

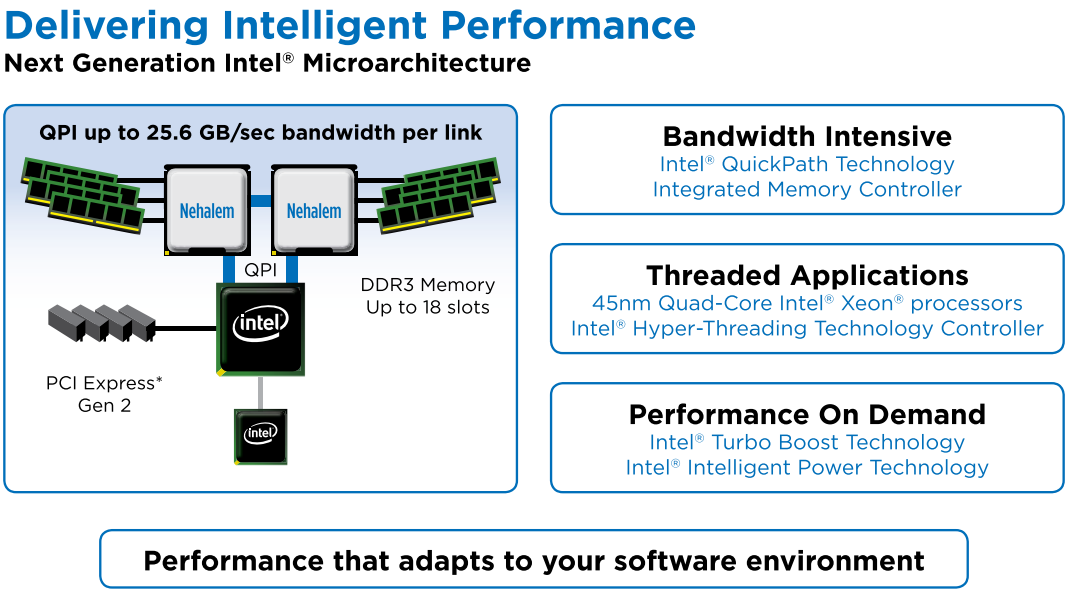
In this mode, all three channels are populated with identical memory modules. This mode permits a larger total memory capacity but does not support SDDC with x8-based memory modules.

A minimal single-channel configuration of 1GB memory modules per processor is also supported in this mode.

SECTION 8. CHIPSET

A. Overview / Description

The PowerEdge R610 planar incorporated the Intel 5520 chipset (code named Tylersburg) for I/O and processor interfacing. Tylersburg is designed to support Intel's 5500 series processors (code named Nehalem-EP), QPI interconnect, DDR3 memory technology, and PCI Express Generation 2. The Tylersburg chipset consists of the Tylersburg-36D IOH and ICH9.



The Intel 5520 chipset (code named Tylersburg) I/O Hub (IOH)

The planar uses the The Intel® 5520 chipset (code named Tylersburg) I/O Hub (IOH)-36D IOH to provide a link between the 5500 series 2S processor (Nehalem EP) and I/O components. The main components of the IOH consist of two full-width QuickPath Interconnect links (one to each processor), 36 lanes of PCI Express Gen2, a x4 Direct Media Interface (DMI), and an integrated IOxAPIC.

IOH QuickPath Interconnect (QPI)

The QuickPath Architecture consists of serial point-to-point interconnects for the processors and the IOH. The PowerEdge R610 has a total of three QuickPath Interconnect (QPI) links: one link connecting the processors and links connecting both processors with the IOH. Each link consists of 20 lanes (full-width) in each direction with a link speed of up to 6.4 GT/s. An additional lane is reserved for a forwarded clock. Data is sent over the QPI links as packets.

The QuickPath Architecture implemented in the IOH and CPUs features four layers. The Physical layer consists of the actual connection between components. It supports Polarity Inversion and Lane Reversal for optimizing component placement and routing. The Link layer is responsible for flow control and the reliable transmission of data. The Routing layer is responsible for the routing of QPI data packets. Finally, the Protocol layer is responsible for high-level protocol communications, including the implementation of a MESIF (Modify, Exclusive, Shared, Invalid, Forward) cache coherence protocol.

Intel Direct Media Interface (DMI)

The DMI (previously called the Enterprise Southbridge Interface) connects the Tylersburg IOH with the Intel I/O Controller Hub (ICH). The DMI is equivalent to a x4 PCIe Gen1 link with a transfer rate of 1 Gb/s in each direction.

PCI Express Generation 2

PCI Express is a serial point-to-point interconnect for I/O devices. PCIe Gen2 doubles the signaling bit rate of each lane from 2.5 Gb/s to 5 Gb/s. Each of the PCIe Gen2 ports are backwards-compatible with Gen1 transfer rates.

In the Tylersburg-36D IOH, there are two x2 PCIe Gen2 ports (1Gb/s) and eight x4 PCIe Gen2 ports (2 Gb/s). The x2 ports can be combined as a x4 link; however, this x4 link cannot be combined with any of the other x4 ports. Two neighboring x4 ports can be combined as a x8 link, and both resulting x8 links can combine to form a x16 link.

Intel I/O Controller Hub 9 (ICH9)

ICH9 is a highly integrated I/O controller, supporting the following functions:

- Six x1 PCIe Gen1 ports, with the capability of combining ports 1-4 as a x4 link
    - These ports are unused on the PowerEdge R610
- PCI Bus 32-bit Interface Rev 2.3 running at 33MHz
- Up to six Serial ATA (SATA) ports with transfer rates up to 300 MB/s
    - The PowerEdge R610 features two SATA port for optional internal optical drive or tape backup
- Six UHCI and two EHCI (High-Speed 2.0) USB host controllers, with up to twelve USB ports
    - The PowerEdge R610 has eight external USB ports and two internal ports dedicated for UIPS. Refer to the Whoville Hardware/BIOS Specification for the USB assignments for each platform
- Power management interface (ACPI 3.0b compliant)
- Platform Environmental Control Interface (PECI)
- Intel Dynamic Power Mode Manager
- I/O interrupt controller
- SMBus 2.0 controller
- Low Pin Count (LPC) interface to Super I/O, Trusted Platform Module (TPM), and SuperVU
- Serial Peripheral Interface (SPI) support for up to two devices
    - The PowerEdge R610's BIOS is connected to the ICH using SPI

SECTION 9. BIOS

A. Overview / Description

The PowerEdge R610 BIOS is based on the Dell BIOS core, and supports the following features:

- Nehalem-EP 2S Support
- Simultaneous Multi-Threading (SMT) support
- CPU Turbo Mode support
- PCI 2.3 compliant
- Plug n' Play 1.0a compliant
- MP (Multiprocessor) 1.4 compliant
- Boot from hard drive, optical drive, iSCSI drive, USB key, and SD card
- ACPI support
- Direct Media Interface (DMI) support
- PXE and WOL support for on-board NICs
- Memory mirroring and spare bank support

- SETUP access through <F2> key at end of POST
- USB 2.0 (USB boot code is 1.1 compliant)
- F1/F2 error logging in CMOS
- Virtual KVM, CD, and floppy support
- Unified Server Configurator (UEFI 2.1) support
- Power management support including DBS, Power Inventory and multiple Power Profiles

The R610 BIOS does not support the following:

- Embedded Diagnostics (embedded in MASER)
- BIOS language localization
- BIOS recovery after bad flash (but can be recovered from iDRAC6 Express)

B. Supported ACPI States

(Advanced Configuration and Power Interface. A standard interface for enabling the operating system to direct configuration and power management).

The Nehalem processor supports the following C-States: C0, C1, C1E, C3, and C6. R610 will support all of the available C-States.

The PowerEdge R610 will support the available P-States as supported by the specific Nehalem processors:

PROC NUMBER	QDF #	FREQUENCY	STANDARD TDP	LFM TDP	P-STATE	NOTES
		1.60			Pmin+0	
		1.73			Pmin+1	
E5502	Q1G8	1.86	80	75	Pmin+2	D-0
E5504	Q1GM	2.00	80	75	Pmin+3	D-0
L5506	Q1HG	2.13	60	52	Pmin+4	D-0
E5506	Q1GL	2.13	80	75	Pmin+4	D-0
L5520	Q1GN	2.26	60	52	Pmin+5	D-0
E5520	Q1GR	2.26	80	75	Pmin+5	D-0
E5530	Q1GK	2.40	80	75	Pmin+6	D-0
E5540	Q1G2	2.53	80	75	Pmin+7	D-0
X5550	Q1GJ	2.67	95	75	Pmin+8	D-0
X5560	Q1GF	2.80	95	75	Pmin+9	D-0
X5570	Q1G9	2.93	95	75	Pmin+10	D-0
W5580	Q1G6	3.20	130	98	Pmin+12	D-0

Table: Nehalem P-State Projections

C. I²C (Inter-Integrated Circuit)

What is I²C? A simple bi-directional 2-wire bus for efficient inter-integrated circuit control. All I²C-bus compatible devices incorporate an on-chip interface that allows them to communicate directly with each other via the I²C-bus. This design concept solves the many interfacing problems encountered when designing digital control circuits. These I²C devices perform communication functions between intelligent control devices (e.g., microcontrollers), general-purpose circuits (e.g., LCD drivers, remote I/O ports, memories), and application-oriented circuits.

The PowerEdge R610, BIOS accesses the I²C through the ICH9 (Intel I/O Controller Hub 9). There are two MUXes on ICH9's I2C bus.

- One MUX (U_ICH_SPD) controls the DIMM SPDs through four split segments
- The other MUX (U_ICH_MAIN) controls the clock buffers, TOE, USB Hub through four split segments.

BIOS controls both the MUXes through the two select lines using GPIO pins.

Clock chip, USB hub, and the front panel EEPROM device addresses are located on the IOH I²C bus.

SECTION 10. EMBEDDED NICS / LAN ON MOTHERBOARD (LOM)

A. Overview / Description

Embedded Gigabit Ethernet Controllers with TCP Offload Engine (TOE) support. Two Broadcom 5709C dual-port Gigabit Ethernet controllers and support circuitry are installed on the system board as independent Ethernet interface devices. From a board perspective, the LOM refers to one of these controllers. From a system perspective, the terms LOM and embedded NIC are interchangeable. LOM1 on the board has two ports: embedded NIC1 and embedded NIC2. These ports could also be called LOM1 and LOM2.

- x4 PCI Express Gen2 capable interface
    - The R610 operates this controller at Gen1 speed
- Integrated MAC and PHY 3072x18 Byte context memory
- 64KB receive buffer
- TOE (TCP Offload Engine)
- iSCSI controller (enabled through an optional hardware key)
- RDMA controller (RNIC) (enabled post-RTS through an optional hardware key)
- NC-SI (Network Controller-Sideband Interface) connection for manageability
- Wake-On-LAN (WOL)
- PXE 2.0 remote boot
- iSCSI boot
- IPv4 and IPv6 support
- Bare metal deployment support

SECTION 11. I/O SLOTS

A. Overview / Description

The PowerEdge R610 requires two PCI Express risers:

- Two PCIe risers (left and center) provide two PCI Express expansion slots, as follows:
- Two x8 PCIe Gen2 slots, connected to the IOH
- One x4 PCIe Gen1 slot for storage on the center riser, connected to the ICH9
- Support for full-height / half-length (6.6" max length) PCIe cards
- System supports 25W maximum power for the first PCIe card and 15W for the second PCIe card

- The lower power support on the second card is due to thermal limitations
- The R610 does not support hot-swapping of PCIe cards

CARD PRIORITY	CARD TYPE	SLOT PRIORITY	MAX ALLOWED	25W CARD
1	PERC 5/E controller	1, 2	1	Y
2	PERC 6/E	1, 2	1	Y
3	10Gb NIC	2, 1	1	Y
4	All other Dell storage cards	1, 2	1	Y
5	All other NICs	2, 1	2	N*
6	Non-Dell storage cards	1, 2	2	N*

*Refer to the expansion card's documentation to determine if the maximum power exceeds 15W. Any cards that exceed 15W will be affected by the restriction of one 25W card

POWEREDGE R610						
PCI Express Gen2 Slots						
Slot 1: Half-Length (6.6" Factory Installation) / Full-Height (x8 connector), x8 link width						
Slot 2: Half-Length (6.6" Factory Installation) / Full-Height (x8 connector), x8 link width						
Category	**Card Priority**	**Description**	**Dell PN**	**PCIe Link Width**	**Slot Priority**	**Max Cards**
Internal Storage (Integrated Slot)	1	Dell™ PERC 6/i Integrated (Sled)	T954J	Gen1 x8	Integrated	1
Internal Storage (Integrated Slot)	2	Dell SAS 6/iR Integrated (Sled)	YK838	Gen1 x8	Integrated	1
External Storage Controller	3	* Dell PERC 5/E Adapter (Test only – no factory install)	GP297	Gen1 x8	Slot 1, 2	1
External Storage Controller	4	*Dell PERC 6/E Adapter (512MB)	J155F	Gen1 x8	Slot 1, 2	1
External Storage Controller	5	*Dell PERC 6/E Adapter (256MB)	F989F	Gen1 x8	Slot 1, 2	1
10Gb NIC	6	*Intel 10GBase-T Copper Single Port NIC	XR997	Gen1 x8	Slot 2, 1	1
10Gb NIC	7	*Broadcom BCM57710 10GBase-T Copper Single Port NIC	RK375	Gen1 x8	Slot 2, 1	1
10Gb NIC	8	Intel® 10GBase-SR Optical Single Port NIC	RN219	Gen1 x8	Slot 2, 1	1
External Storage Controller	9	*Dell SAS 5/E Adapter	M778G	Gen1 x8	Slot 1, 2	1

Category	Card Priority	Description	Dell PN	PCIe Link Width	Slot Priority	Max Cards
1Gb NIC	10	Intel Gigabit VT Copper Quad Port NIC	YT674	Gen1 x4	Slot 2, 1	2
1Gb NIC	11	Intel PRO/1000PT Gigabit Copper Dual Port NIC	X3959	Gen1 x4	Slot 2, 1	2
1Gb NIC	12	Broadcom BCM5709C IPV6 Gigabit Copper Dual Port NIC with TOE and iSCSI Offload	F169G	Gen1 x4	Slot 2, 1	2
1Gb NIC	13	Broadcom BCM5709C IPv6 Gigabit Copper Dual Port NIC with TOE	G218C	Gen1 x4	Slot 2, 1	2
Fibre Channel 8 HBA	14	Emulex LPe12002 FC8 Dual Channel HBA	C856M	Gen2 x4	Slot 1, 2	2
Fibre Channel 8 HBA	15	Emulex LPe12000 FC8 Single Channel HBA	C855M	Gen2 x4	Slot 1, 2	2
Fibre Channel 4 HBA	16	Emulex LPe11002 FC4 Dual Channel HBA	KN139	Gen1 x4	Slot 1, 2	2
Fibre Channel 4 HBA	17	Emulex LPe1150 FC4 Single Channel HBA	ND407	Gen1 x4	Slot 1, 2	2
Fibre Channel 4 HBA	18	QLogic QLE2462 FC4 Dual Channel HBA	DH226	Gen1 x4	Slot 1, 2	2
Fibre Channel 4 HBA	19	QLogic QLE2460 FC4 Single Channel HBA	PF323	Gen1 x4	Slot 1, 2	2
SCSI HBA	20	LSI Logic LSI2032 SCSI HBA	NU947	Gen1 x4	Slot 1, 2	2
Fibre Channel 8 HBA	21	QLogic QLE2562 FC8 Dual Channel HBA	G444C	Gen2 x4	Slot 1, 2	2
Fibre Channel 8 HBA	22	QLogic QLE2560 FC8 Single Channel HBA	G425C	Gen2 x4	Slot 1, 2	2
Fibre Channel 4 HBA	23	QLogic QLE220 FC4 Single Channel HBA	YY004	Gen1 x4	Slot 1, 2	2

This list was generated based on thermal, mechanical, and performance inputs. Generally speaking, thermal requirements were a priority for any card over 15W (PERC and most 10G NIC cards). For the rest of the cards, thermal requirements were the priority except where there were conflicts with strict mechanical requirements. Performance considerations were not a factor since both slots were Gen2 with 8x link width.

NOTE: The PowerEdge R610 supports a maximum of one 25W card regardless of which slot is populated (does not apply to the Internal Storage Slot). This restriction applies to any PCIe cards that have a maximum power over 15W. PCIe cards that are affected by this restriction are noted by an asterisk.

B. Boot Order

Refer to the Whoville BIOS Specification for the most up-to-date lane assignments and scan order

PCIe scan order (from the BIOS HW spec v1.0)
IOH port 1,2 (PCI Express Gen1 x4) – Broadcom BCM5709C Gigabit LOM #1
IOH port 3 (PCI Express Gen1 x4) – Broadcom BCM5709C Gigabit LOM #2
ICH9 port 1-4 (PCI Express Gen1 x4) – Integrated PERC6i or SAS6i on the Center riser
IOH port 7/8 (PCI Express Gen2 x8) – Slot 1 on the "center" riser
IOH port 9/10 (PCI Express Gen2 x8) – Slot 2 on the "left" riser

SECTION 12. STORAGE

A. Overview / Description

I. 2.5" SAS Backplane Subsystem

The PowerEdge R610 has a single six-drive backplane for 2.5" drives. There are six hot-swap capable Serial Attached SCSI (SAS) or Serial ATA (SATA) slots with two LED indicators per slot, two Mini-SAS cable connectors for connecting the backplane to the integrated SAS 6/iR or PERC 6/i, and a 14-pin power connector. For SATA/SAS mixing, up to four SATA drives are supported with the 2.5" backplane. In this configuration, one pair of drives will be SAS and the remaining drives will be SATA.

II. Cabling

Two Mini-SAS cables are used to connect both channels of the integrated storage card to the six-drive backplane. The Mini-SAS A connector connects drives 0 through 3 and the Mini-SAS B connector connects drives 4 and 5 to the storage card.

B. Drives

I. Internal Hard Disk Drives

The PowerEdge R610 system supports up to six 2.5" hard disk drives.

- Support for 10,000 and 15,000 rpm SAS drives
- Support for 7,200 rpm Enterprise SATA and SATAu drives
- Hard drives must use the Hannibal drive carrier
- Up to six SAS or up to six SATA drives are supported
    - For SAS/SATA mixing, two SAS and up to four SATA drives are possible
- A pair of SAS drives must be installed in slots 0 and 1
- Support for Solid State Drives (SSD)
    - SSDs require the PERC 6/i Integrated storage controller and cannot be mixed with any other type of hard drive

2.5 HDDs	
2.5" Enterprise SATA 7.2K HDs:	160GB, 250GB, and 500GB
2.5" SAS 10K HDs	73GB, 146GB, and 300GB
2.5" entry 10K SAS in Boss Hogg 3.5" HDD carrier	
2.5" SAS 15K HDs	73GB, 146GB
2.5" Enterprise SATA SSD	25GB, 50GB, 100GB
2.5" SSD	25GB, 50GB

	POWEREDGE R610
Platforms	✔
All 2.5" HDD SAS (or) SATA	✔
All 2.5" SSD* **	✔
Mixed SSD/SAS**	N/A
All 3.5" HDD SAT (or) SATA	N/A
Mixed SAS/SATA*	✔
2.5" SAS in 3.5" HDD Carrier (RTS+)	N/A
2.5" SAS HDD in 3.5" HDD Carrier + 3.5" SATA HDDs (Mixed SAS)	N/A
2.5" SAS HDD in 3.5" HDD Carrier + 3.5" SATA HDDs (Mixed SAS/SATA)*	N/A

- SAS HDDs should be in slots 0 & 1 and min/max number of SAS HDDs is 2, the rest will be SATA HDDs and min/max number of SATA HDDs depends on the configuration.
- **No maximum for SAS HDD's combined with SSD
- ***SSD Support requires PERC 6/i

20GB and 50GB solid state drives (SSD) support will be supported at RTS

I. Hard Disk Drive Carriers
Hard drives must use the Dell drive carrier for 2.5" drives (legacy drive carriers are not supported).

II. Empty Drive Bays
For the slots that are not occupied by drives, a carrier blank is provided to maintain proper cooling, maintain a uniform appearance to the unit, and provide EMI shielding.

III. Diskless Configuration Support
The system supports diskless configuration with no storage controller (SAS 6/iR or PERC 6i) installed in the system. A 2.5" HDD backplane is still installed in this configuration.

IV. Hard Drive LED Indicators
Each disk drive carrier has two LED indicators visible from the front of the system. One is a green LED for disk activity and the other is a bicolor (green/amber) LED for status information. The activity LED is driven by the disk drive during normal operation. The bicolor LED is controlled by the SEP device on the backplane. Both LEDs are used to indicate certain conditions under direction of a storage controller.

C. RAID Configurations

CONFIG TYPE	CONFIGS		DESCRIPTION	NON-MIXED DRIVES, ALL SATA OR ALL SAS		MIXED SAS/ SATA MIN 2xSAS+1xSATA MAX 2XSAS + 4XSATA		ATTACH RATE
				MIN HDD	MAX HDD	MIN HDD	MAX HDD	
NoHDD	0	NZC	No controller/ No hard drive	2.5"= 0	2.5"= 0	N/A		3%
SAS/SATA (No RAID)	1	MSS	Motherboard SAS/SATA: SAS 6/iR, No RAID, (Integrated ports SAS/SATA controller)	2.5"= 1	2.5"= 6			6%
SAS/SATA (RAID)	2	MSSR0	Integrated SAS/SATA RAID 0 (PERC 6/i, SAS 6/iR)	2.5"= 1	2.5"= 6	N/A		7%
	3	MSSR1	Integrated SAS/SATA RAID 1 (PERC 6/i, SAS 6/iR)	2.5"= 2	2.5"= 2	N/A		17%
	4	MSSR5	Integrated SAS/SATA RAID 5 (PERC 6/i)	2.5"= 3	2.5"= 6	N/A		22%
	5	MSSR10	Integrated SAS/SATA RAID 10 (PERC 6/i)	2.5"= 4	2.5"= 6	N/A		7%
	6	MSSR0/ R0	Integrated SAS/SATA RAID 0/RAID 0 (PERC 6/i, SAS6/iR)	2.5"= 1+1*	2.5"= 6			5%
	7	MSSR1/ R1	Integrated SAS/SATA RAID 1/RAID 1 (PERC 6/i, SAS 6/iR)	2.5"= 2+2	2.5"= 2+2			6%
	8	MSSR1/ R5	Integrated SAS/SATA RAID 1/RAID 5 (PERC 6/i)	2.5"= 2+3	2.5"= 2+4			15%
	9	MSSR1/ R10	Integrated SAS/ SATA RAID 1/RAID 10 (PERC 6/i)	2.5"= 2+4	2.5"= 2+4			5%
	10	MSSR6	Integrated SAS/SATA RAID 6 (PERC 6/i)	2.5"= 4	2.5"= 6	N/A		7%

CONFIG TYPE	CONFIGS		DESCRIPTION	NON-MIXED DRIVES, ALL SATA OR ALL SAS		MIXED SAS/ SATA MIN 2xSAS+1xSATA MAX 2XSAS + 4XSATA		ATTACH RATE
				MIN HDD	MAX HDD	MIN HDD	MAX HDD	
SAS/SATA (No RAID)	11	Mss-X	Motherboard SAS/SATA: SAS 6/iR, No RAID, (Integrated ports SAS/SATA controller)			2.5"= 3	2.5"= 6	
SAS/SATA (RAID)	12	MSSR0/ R0-X	Integrated SAS/SATA RAID 0/RAID 0 (PERC 6/i, SAS6/iR)			2.5"= 2+1	2.5"= 2+4	
	13	MSSR1/ R1-X	Integrated SAS/SATA RAID 1/RAID 1 (PERC 6/i, SAS 6/iR)			2.5"= 2+2	2.5"= 2+2	
	14	MSSR1/ R5-X	Integrated SAS/SATA RAID 1/RAID 5 (PERC 6/i)			2.5"= 2+3	2.5"= 2+4	
	15	MSSR1/ R10-X	Integrated SAS/SATA RAID 1/RAID 10 (PERC 6/i)			2.5"= 2+4	2.5"= 2+4	
	16	MSSR1	Integrated SSD RAID 1 (PERC 6/i, SAS 6/iR)	2.5"= 2	2.5"= 2	N/A		
	17	MSSR5	Integrated SSD RAID 5 (PERC 6/i)	2.5"= 3	2.5"= 6	N/A		
	18	MSSR10	Integrated SSD RAID 10 (PERC 6/i)	2.5"= 4	2.5"= 6	N/A		

D. Storage Controllers

I. SAS 6/iR

The PowerEdge R610 internal SAS 6/iR HBA is an expansion card that plugs into a dedicated PCI Express x8 slot (only four lanes wired). It incorporates two four-channel SAS IOCs for connection to SAS/SATA hard disk drives. It is designed in a form factor that allows the same card to be used in R610 and T610.

II. PERC 6i

For customers who want a hardware RAID solution, the PERC 6i is an option. The PERC 6i uses the LSI 1078 ROC (RAID on Chip) processor with a PCI Express host interface and DDR2 memory. A battery is also available for backup.

	PRODUCT	USAGE	R610 SUPPORT	SLOT	PCIe CON	PCIe BRACKET	I/O CON	RAID	BBU
PERC SAS/SATA	PERC 6/i Integrated	Internal Backplane Storage (HDD, SSD)	Yes, Max 1	Storage slot	x8	No	x4 int x4 int	0, 1, 5, 6, 10, 50, and 60	Yes
	PERC 6/E Adapter	External SAS/SATA Storage	Yes, Max 1 (MD1000 Pompano & MD1020 Ridgeback)	PCIe slot	x8	Yes	x4 ext x4 ext	0, 1, 5, 6, 10, 50, and 60	TBBU
	PERC 5/E Adapter	External Legacy Storage	Yes, Max 1 (MD1020 and Ridgeback)	PCIe slot	x8	Yes	x4 ext x4 ext	0, 1, 5, 10, 50	TBBU
SAS HBA SAS/SATA	SAS 6/iR Integrated	Internal Backplane Storage (No tape or SSD support)	Yes, Max 1	Storage slot	x8	No	x4 int x4 int	0, 1	No
	SAS 5/E Adapter	External SAS (DAS, Tape)	Yes, Max 1	PCIe slot	x8	Yes	x4 ext x4 ext	none	No
ICH9	On Planar via chipset	Internal slim-line SATA Optical and/or TBU Only (no HDD)	Yes, 1 port for optical	n/a	n/a	n/a	1x int	n/a	n/a
LSI 2032 SCSI	LSI 2032 Adapter	External SCSI Tape/ Legacy External storage	Yes, Max 2	PCIe slot	x8	Yes	1x int 1x ext	n/a	n/a

E. LED Indicators

Each disk drive carrier has two LED indicators visible from the front of the system. One is a green LED for disk activity and the other is a bicolor (green/amber) LED for status information. The activity LED is driven by the disk drive during normal operation. The bicolor LED is controlled by the SEP device on the backplane. Both LEDs are used to indicate certain conditions under direction of a storage controller.

F. Optical Drives

SATA optical drives are optional in all PowerEdge R610 systems and connect to the planar. IDE drives are no longer supported. The following slimline drives are available on Thidwick: DVD-ROM and DVD+RW. If the drive is not ordered with the system, a blank should be installed in its place.

G. Tape Drives

The R610 does not support an internal tape drive. The PowerEdge R610 only supports external tape drives; see the SDL for more information about specific external TBU support.

SECTION 13. VIDEO

A. Overview / Description

The PowerEdge R610 system Integrated Dell Remote Access Controller 6 (iDRAC6) incorporates an integrated video subsystem, connected to the 32-bit PCI interface of the ICH9. This logic is based on the Matrox G200. The device only supports 2D graphics. The video device outputs are multiplexed between the front and rear video ports. If a monitor is connected to the front video connector, it will take precedence over the rear connection, thereby removing the display from the rear connection. The integrated video core shares its video memory with the iDRAC6's 128MB DDR2 application space memory. This memory is also used for the KVM buffer.

The Thidwick system supports the following 2D graphics video modes:

RESOLUTION	REFRESH RATE (Hz)	COLOR DEPTH (BIT)
640 x 480	60, 72, 75, 85	8, 16, 32
800 x 600	56, 60, 72, 75, 85	8, 16, 32
1024 x 768	60, 72, 75, 85	8, 16, 32
1152 x 864	75	8, 16, 32
1280 x 1024	60, 75, 85	8, 16
1280 x 1024	60	32

SECTION 14. AUDIO

A. Overview / Description

No speakers supported

SECTION 15. RACK INFORMATION

A. Overview / Description

Rack installation components such as rails are provided with the PowerEdge R610 Rack Kit. The rack installation components are as follows: sliding rack mount with latest generation Cable Management Arm (CMA). The PowerEdge R610 will feature slam latches to offer easier removal from the rack. When the system is installed in a rack, please observe the following guidelines:

Nothing should be located within 12" of the front of the unit that would restrict the airflow into the system.

Nothing should be mounted or placed behind the chassis that would restrict airflow from exiting the system. Only Dell-approved CMAs can be placed behind the chassis. All other objects should be located at least 24" away from the rear of the chassis.

When two systems are placed back to back, the separation between the units should be at least 24" if the exit airflow is equivalent for the two chassis. This will allow the exit air to escape without creating an extreme back pressure at the rear of one of the chassis.

B. Cable Management Arm (CMA)

CABLE TYPE	NUMBER OF CABLES
Mouse – USB	1
Keyboard – USB	1
Video – VGA	1
Power Cords	2
LOMs – Ethernet	1
PCI NICs	1
Total	7

Notes:
- CMA supports for the maximum number of cables supported by system
- The numbers in this matrix represent the number and types of external cables required to be supported by the CMA solution.
- This matrix is built on the practical worst case configuration in each platform based on prior and projected take rates. Note that other combinations of adapters and associated cables exist, but are assumed to fall within these guidelines from the standpoint of bend radius and flexibility, cable bundling, cable volume, etc.
- PCI NIC cables are assumed to be Ethernet.
- KVM cable dongle may be used for mouse/keyboard/video.

C. Rails

Support for tool-less installation in CEA-310-E compliant square hole 4-post racks including: Support for Dell 2410 24U Rack Support for Dell 4210 Rack Support for HP/Compaq 10xxx series
Support for tooled or tool-less installation in CEA-310-E compliant round hole 4-post racks (tool-less preferred)
Support for flush and center mount installation in CEA-310-E compliant 2-post racks (1U & 2U only)

The R610 rail supports the following racks:

Support for Dell 4210 & 2410 racks
Support for Dell 4200 & 2400 racks without CMA
Support for HP/Compaq 10XXX series racks
Support for HP/Compaq 9XXX & 7XXX series racks without CMA

SECTION 16. OPERATING SYSTEMS

A. Overview / Description

The PowerEdge R610 supports both Windows and Linux Operating Systems.

B. Operating Systems Supported

Windows® support:

X86 OR X64	INSTALLATION	FACTORY INSTALLATION	LOGO CERTIFICATION	SCHEDULE	TEST/ VALIDATE	SUPPORT
Windows® Small Business Server 2008 and Essential Business Server 2008						
x64	Standard/ Premium	Yes	Windows Hardware Quality Labs - Windows 2008	Shipping	Yes	Yes
Windows Server® 2008 (x64 includes Hyper-V™)						
x64	Standard	Yes	Windows Hardware Quality Labs - Windows 2008	Shipping	Yes	Yes
	Enterprise					
	Datacenter					
Windows Server® 2008						
x86	Standard	Yes	Windows Hardware Quality Labs - Windows 2008	Shipping	Yes	Yes
	Enterprise					

Windows® Web Server 2008						
x86 and x64	Web	Yes	Windows Hardware Quality Labs - Windows 2008	Shipping	Yes	Yes
Windows Server® 2008, SP2 (x64 includes Hyper-V™)						
x64	Standard	Yes	Windows Hardware Quality Labs - Windows 2008	Available in August - October 2009	Yes	Yes
	Enterprise					
	Datacenter					
Windows Server® 2008, SP2						
x86	Standard	Yes	Windows Hardware Quality Labs - Windows 2008	Available in August - October 2009	Yes	Yes
	Enterprise					
Windows® Web Server 2008, SP2						
x86 and x64	Web	Yes	Windows Hardware Quality Labs - Windows 2008	Available in August - October 2009	Yes	Yes
Windows Server® 2008, R2, (x64 includes Hyper-V™)						
x64	Standard	Yes	Windows Hardware Quality Labs - Windows 2008 Release 2	Available in November 2009 - January 2010	Yes	Yes
	Enterprise					
	Datacenter					

Linux support:

Red Hat® Enterprise Linux 4.7						
x86 and x64	ES/AS	Available in June 2009	N/A	Available in June 2009	Yes	Yes
Red Hat Enterprise Linux 5.2						
x86 and x64	Standard/AP	Yes	N/A	Shipping	Yes	Yes
Red Hat Enterprise Linux 5.3						
x86 and x64	Standard/AP	Available in June 2009	N/A	Available in June 2009	Yes	Yes
Novell® SUSE® Linux Enterprise Server 10 SP2						
x64	Enterprise	Yes	N/A	Shipping	Yes	Yes
Novell SUSE Linux Enterprise Server 11						
x64	Enterprise	Available in June 2009	N/A	Available in June 2009	Yes	Yes
Solaris™ 10 05/09						
x64	Enterprise	Drop in the box	N/A	Available in June 2009	Yes	Yes

SECTION 17. VIRTUALIZATION

A. Overview / Description

Supported embedded hypervisors:

- Microsoft® Windows Server® 2008 Hyper-V
- VMware® ESXi Version 4.0 and 3.5 update 4
- Citrix® XenServer 5.0 with Hotfix 1 or later

SECTION 18. SYSTEMS MANAGEMENT

A. Overview / Description

Dell is focused on delivering open, flexible, and integrated solutions the help our customers reduce the complexity of managing disparate IT assets. We build comprehensive IT management solutions. Combining Dell PowerEdge Servers with a wide selection of Dell-developed management solutions, we provide customers choice and flexibility – so you can simplify and save in environments of any size.

To help you meet your server performance demands, Dell offers Dell OpenManage™ systems management solutions for:

- Deployment of one or many servers from a single console
- Monitoring of server and storage health and maintenance
- Update of system, operating system, and application software

We offer IT management solutions for organizations of all sizes – priced right, sized right, and supported right.

B. Server Management

A Dell Systems Management and Documentation DVD and a Dell Management Console DVD are included with the product. ISO images are also available. The following sections briefly describe the content.

Dell Systems Build and Update Utility: Dell Systems Build and Update Utility assists in OS install and pre-OS hardware configuration and updates.

OpenManage Server Administrator: The OpenManage Server Administrator (OMSA) tool provides a comprehensive, one-to-one systems management solution, designed for system administrators to manage systems locally and remotely on a network. OMSA allows system administrators to focus on managing their entire network by providing comprehensive one-to-one systems management.

Management Console: Our legacy IT Assistant console is also included, as well as tools to allow access to our remote management products. These tools include: Remote Access Service, for iDRAC, and the BMC Management Utility.

Active Directory Snap-in Utility: The Active Directory Snap-in Utility provides an extension snap-in to the Microsoft Active Directory. This allows you to manage Dell specific Active Directory objects. The Dell-specific schema class definitions and their installation are also included on the DVD.

Dell Systems Service Diagnostics Tools: Dell Systems Service and Diagnostics tools deliver the latest Dell optimized drivers, utilities, and operating system-based diagnostics that you can use to update your system.

eDocs: The section includes Acrobat files for PowerEdge systems, storage peripheral and OpenManage software.

Dell Management Console DVD: The Dell Management Console is a Web-based systems management software that enables you to discover and inventory devices on your network. It also provides advanced functions, such as health and performance monitoring of networked devices and patch management capabilities for Dell systems.

Server Update Utility: In addition to the Systems Management Tools and Documentation and Dell Management Console DVDs, customers have the option to obtain Server Update Utility DVD. This DVD has an inventory tool for managing updates to firmware, BIOS and drivers for either Linux or Windows varieties.

C. Embedded Server Management

The PowerEdge R610 implements circuitry for the next generation of Embedded Server Management. It is Intelligent Platform Management Interface (IPMI) v2.0 compliant. The iDRAC6 (Integrated Dell Remote Access Controller) is responsible for acting as an interface between the host system and its management software and the periphery devices. These periphery devices consist of the PSUs, the storage backplane, integrated SAS HBA or PERC 6/i and control panel with semi-intelligent display.

The iDRAC6 provides features for managing the server remotely or in data center lights-out environments. Advanced iDRAC features require the installation of the iDRAC6 Enterprise card.

I. Unmanaged Persistent Storage

The unmanaged persistent storage consists of two ports:

- one located on the control panel board
- one located on the Internal SD Module.

The port on the control panel is for an optional USB key and is located inside the chassis. Some of the possible applications of the USB key are:

- User custom boot and pre-boot OS for ease of deployment or diskless environments
- USB license keys for software applications like eToken™ or Sentinel Hardware Keys
- Storage of custom logs or scratch pad for portable user-defined information (not hot-pluggable)

The Internal SD Module is dedicated for an SD Flash Card with embedded Hypervisor for virtualization. The SD Flash Card contains a bootable OS image for virtualized platforms.

II. Lifecycle Controller/Unified Server Configurator

Embedded management is comprised of several pieces which are very interdependent.

- Lifecycle Controller
- Unified Server Configurator
- iDRAC6
- vFLASH

Lifecycle controller is the hardware component that powers the embedded management features. It is integrated and tamperproof storage for system-management tools and enablement utilities (firmware, drivers, etc.). It is flash partitioned to support multiple, future use cases

Dell Unified Server Configurator is a 1:1 user interface exposing utilities from Lifecycle Controller. Customers will use this interface to configure hardware, update server, run diagnostics, or deploy the operating system. This utility resides on Lifecycle Controller. To access the Unified Server Configurator, press <F10> key within 10 seconds of the Dell logo display during the system boot process. Current functionality enabled by the Unified Server Configurator includes:

FEATURE	DESCRIPTION
Faster O/S Installation	Drivers and the installation utility are embedded on system, so no need to scour DELL.COM
Faster System Updates	Integration with Dell support automatically directed to latest versions of the Unified Server Configurator
More Comprehensive Diagnostics	Diagnostic utilities are embedded on system
Simplified Hardware Configuration	Detects RAID controller and allows user to configure virtual disk and choose virtual disk as boot device, eliminating the need to launch a separate utility

III. iDRAC6 Express

The iDRAC6 Express is the first tier of iDRAC6 upgrades. In addition to upgrading the system with a Lifecycle Controller, the iDRAC6 Express offers the following key features:

- Graphical web interface
- Standard-based interfaces

- Server Sensor monitoring and fault alerting
- Secure operation of remote access functions including authentication, authorization, and encryption
- Power control and management with the ability to limit server power consumption and remotely control server power states
- Advanced troubleshooting capabilities

For more information on iDRAC6 Express features see the table below.

IV. iDRAC6 Enterprise
The optional iDRAC6 Enterprise card provides access to advanced iDRAC6 features. The iDRAC6 Enterprise connects directly to the R610 planar and is mounted parallel to the planar with stand-offs.

Key features for the iDRAC6 Enterprise include:
- Scripting capability with Dell's Racadm command-line
- Remote video, keyboard, and mouse control with Virtual Console
- Remote media access with Virtual Media
- Dedicated network interface

Additionally, the iDRAC6 Enterprise can be upgraded by adding the vFlash Media card. This is a 1GB Dell branded SD card that enabled a persistent 256MB virtual flash partition. In the future, vFlash will be expanded to include additional features.

A more detailed feature list for iDRAC6 Enterprise and vFlash is included in the table below.

FEATURE	BMC	IDRAC6 EXPRESS	IDRAC6 ENTERPRISE	VFLASH MEDIA
Interface and Standards Support				
IPMI 2.0	✔	✔	✔	✔
Web-based GUI		✔	✔	✔
SNMP		✔	✔	✔
WSMAN		✔	✔	✔
SMASH-CLP		✔	✔	✔
Racadm command-line			✔	✔
Conductivity				
Shared/Failover Network Modes	✔	✔	✔	✔
IPv4	✔	✔	✔	✔
VLAN tagging	✔	✔	✔	✔
IPv6		✔	✔	✔
Dynamic DNS		✔	✔	✔
Dedicated NIC			✔	✔
Security & Authentication				
Role-based Authority	✔	✔	✔	✔

FEATURE	BMC	IDRAC6 EXPRESS	IDRAC6 ENTERPRISE	VFLASH MEDIA
Local Users	✔	✔	✔	✔
Active Directory		✔	✔	✔
SSL Encryption		✔	✔	✔
Remote Management & Remediation				
Remote Firmware Update	✔ [1]	✔	✔	✔
Server power control	✔ [1]	✔	✔	✔
Serial-over-LAN (with proxy)	✔	✔	✔	✔
Serial-over-LAN (no proxy)		✔	✔	✔
Power capping		✔	✔	✔
Last crash screen capture		✔	✔	✔
Boot capture		✔	✔	✔
Serial-over-LAN		✔	✔	✔
Virtual media			✔	✔
Virtual console			✔	✔
Virtual console sharing			✔	✔
Virtual flash				✔
Monitoring				
Sensor Monitoring and Alerting	✔ [1]	✔	✔	✔
Real-time Power Monitoring		✔	✔	✔
Real-time Power Graphing		✔	✔	✔
Historical Power Counters		✔	✔	✔
Logging Features				
System Event Log	✔	✔	✔	✔
RAC Log		✔	✔	✔
Trace Log		✔	✔	✔

SECTION 19. PERIPHERALS

A. USB Peripherals

The R610 supports the following USB devices:

- DVD (bootable; requires two USB ports)
- USB Key (bootable)
- Keyboard (only one USB keyboard is supported)
- Mouse (only one USB mouse is supported

B. External Storage

EXTERNAL STORAGE	
SAN Support	EMC's AX Arrays (SCSI, FC, and iSCSI)
	EMC's CX Arrays (SCSI, FC, and iSCSI)
	EqualLogic's PS5XXX Arrays (iSCSI)
SAS Management SW for xBOD	OMSS X.X for MD1000
	OMSS X.X for MD1020
	X.X for MD3000
	for MD3000i
PV NAS	Attachment to Lightning (PV NX1950) including iSCSI and clustering support
	Attachment to Warrior (Win Storage Server on PE)
	Attachment to EMC NS500G
PV DAS	MD1000 JBOD
	MD3000 RBOD
	MD1120 2.5 SAS/SATA JBOD
	MD1100 3.5 SAS/SATA JBOD
PV SAN	MD3000i iSCSI RAID array
EqualLogic™	PS5000 family
	PS5500 family
SAS xBOD SW	OpenManage Storage Manager

Section 20. Documentation

A. Overview, Description, and List

PowerEdge R610 and other 11G systems use the new Enterprise documentation set. The following is a summary of some of the documents slated for the R610 product. For the complete list of documents, including language requirements and delivery scheduling, refer to the Documentation Matrix and the Documentation Milestones in the InfoDev Functional Publications Plan.

- **Getting Started Guide:** This guide provides initial setup steps, a list of key system features, and technical specifications. This document is required for certain worldwide regulatory submittals. This guide is printed and shipped with the system, and is also available in PDF format on the Dell support site.
- **Hardware Owner's Manual:** This document provides troubleshooting and remove/replace procedures, as well as information on the System Setup program, system messages, codes, and indicators. This document is provided to customers in HTML and PDF format at the Dell support site.
- **System Information Label:** The system information label documents the system board layout and system jumper settings and is located on the system cover. Text is minimized due to space limitations and translation considerations. The label size is standardized across platforms.
- **Information Update:** This is a PDF document that provides information on late changes and issues having significant customer impact which were discovered after document signoff.
- **General System Information Placemat:** This is a paper document that is provided with every system. The document provides general information about the system, including software license agreement information and the location of the service tag.
- **Rack Placemat:** This is a paper document that is provided with the rack kits. The document provides an overview of procedures for setting up the rack.

SECTION 21. PACKAGING OPTIONS

PACKAGING	PROVIDE PACKAGING TO SUPPORT SYSTEM	
	Packaging should incorporate keyboard, mouse, bezel, Doc, CDs, rails	• Will not bag the server in outbound pack • Multi-pack rails targeted to go in a box within the multi-pack but investigation underway for a separate box for ease of customer staging • Accessory tray needs a cover and icon showing contents • Doc Box – separate box within the main box containing import documentation and software (OS, OM, etc.)

Appendix

See page 13 for more information on the volatility chart.

R610 Volatility Chart.

	NON-VOLATILE RAM	VOLATILE RAM	REFERENCE DESIGNATOR	QTY	SIZE	TYPE [e.g., FLASH PROM, EEPROM]:
PLANAR, POWEREDGE R610						
System BIOS SPI Flash	Y		U_SPI_BIOS	1	4MB	Flash EEPROM (SPI interface)
LOM Configuration Data	Y		U15, U16	2	512KB	FLASH (NOR)
iDRAC6 Controller ROM	Y		U_IBMC	1	4KB	ROM
iDRAC6 Controller RAM		Y	U_IBMC	1	8KB	RAM
System CPLD	Y		U_CPLD	1	1200 Macro cells	Internal Flash EEPROM
System CPLD		Y	U_CPLD	1	1KB	RAM
iDRAC6 Express Internal Flash	Y		U_EMMC	1	1GB	NAND FLASH
System RAM		Y	J_CPU(2:1)_ CH(2:0)_ DIMM(3:1)	18	up to 18 DIMMs *16GB	RAM
TPM ID EEPROM (Plug in module only)	Y		U_SEEPROM	1	256B	EEPROM
TPM Binding EEPROM (on China planar only)	Y		U7261	1	256B	EEPROM
iDRAC6 SDRAM		Y	U_IBMC_ MEM	1	128MB	DDR2 RAM
iDRAC6 FRU	Y		U_IBMC_ FRU	1	4KB	EEPROM
iDRAC6 Boot Block Flash	Y		U_IBMC_SPI	1	2MB	FLASH (NOR)
Trusted Platform Module	Y	N	U_TPM	1	128 bytes	EEPROM
CHIPSET						
CMOS	Y		U_ICH9	1	256KB	Battery backed RAM
2.5" BACKPLANE OR 3.5" BACKPLANE						
Storage Controller Processor	Y		U_SEP	1	32KB	Embedded Microcontroller Flash
CONTROL PANEL						
Internal USB	Y		J_USBKEY (connector)	1	User selectable	License key hard set ROM or user choice
Internal SD Module	Y		J_SDCARD (Connector)	1	User selectable - 1GB shipped	Secure Digital NAND Flash
POWER SUPPLY						
PSU Microcontroller	Y		Varies by part number	Up to 2	Maximum supported = 2MB per PSU	Embedded microcontroller flash
PERC 6/I INTEGRATED						
PERC NVSRAM Config Data	Y		U23	1	32KB	Non-volatile SRAM
PERC Firmware	Y		U24	1	4MB	FLASH (NOR)
PERC Cache RAM		Y	U58-61	1	256MB	RAM
FRU	Y		U40	1	256MB	EEPROM
IBUTTON Key EEPROM	Y		U21	1	1KB	EEPROM
CPLD	Y		U_CPLD	1	72 macrocells	Internal Flash EEPROM
SAS 6/iR Integrated						
Controller Configuration Data	Y		U3	1	4MB	FLASH (NOR)
FRU	Y		U4	1	256KB	EEPROM
Integrated Mirroring NVSRAM	Y		U1	1	32KB	Non-volatile SRAM
iDRAC6 Enterprise						
VFlash	Y		J_SD (connector)	1	1GB @ RTS, Larger later	Secure Digital NAND Flash

R610 Volatility Chart Continued.

	CAN USER PROGRAMS OR OPERATING SYSTEM WRITE DATA TO IT DURING NORMAL OPERATION?	PURPOSE? [e.g., BOOT CODE]
PLANAR, POWEREDGE R610		
System BIOS SPI Flash	No	Boot Code, System Configuration Information, EUFI environment
LOM Configuration Data	No	LAN on motherboard configuration and firmware
iDRAC6 Controller ROM	No	not utilized
iDRAC6 Controller RAM	No	iDRAC internal RAM
System CPLD	No	System-specific hardware logic
System CPLD	No	not utilized
iDRAC6 Express Internal Flash	No for iDRAC Operating System. Yes for Managed System Services Repository	iDRAC Operating System plus Managed System Services Repository (i.e., Unified Server Configurator, OS drivers, diagnostics, rollback versions of various programmables)
System RAM	Yes	System OS RAM
TPM ID EEPROM (Plug in module only)	No	BIOS Identification of TPM module
TPM Binding EEPROM (on China planar only)	No	BIOS binding of plug in module to a particulare planar
iDRAC6 SDRAM	No	BMC OS + VGA frame buffer
iDRAC6 FRU	No	Motherboard electronic product identifier
iDRAC6 Boot Block Flash	No	iDRAC boot loader and configuration (i.e., MAC address), life cycle log, and system event log
Trusted Platform Module	yes	Storage of encryption keys
CHIPSET		
CMOS	No	BIOS settings
2.5" BACKPLANE OR 3.5" BACKPLANE		
Storage Controller Processor	No	Backplane firmware (HDD status, etc.)
CONTROL PANEL		
Internal USB	Yes as allowed by OS	Normal usage is read only software license key, but not limited
Internal SD Module	Yes as allowed by OS	Normal usage is embedded hypervisor OS but not limited
POWER SUPPLY		
PSU Microcontroller	No	Power supply operation, power telemetry data, and fault behaviors
PERC 6/I INTEGRATED		
PERC NVSRAM Config Data	No	Stores configuration data of HDDs
PERC Firmware	No	Storage Controller Firmware
PERC Cache RAM	No - not directly.	Storage RAID controller cache
FRU	No	Card product identification for system inventory purposes
IBUTTON Key EEPROM	No	Feature enablement encyrpted key
CPLD	No	HW control logic (i.e., power sequencing)
SAS 6/iR Integrated		
Controller Configuration Data	No	Stores configuration data of HDDs
FRU	No	Card product identification for system inventory purposes
Integrated Mirroring NVSRAM	No	Stores configuration data of HDDs
iDRAC6 Enterprise		
VFlash	Yes - When enabled, installed, and the media does not have the write protect switch applied	Storage of logs, user images like files, drivers, OS's, etc.

R610 Volatility Chart Continued.

	HOW IS DATA INPUT TO THIS MEMORY?
PLANAR, POWEREDGE R610	
System BIOS SPI Flash	Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable containing the firmware file and the loader. System loaded with arbitrary data in firmware memory would not operate. Future firmware releases may add support for recovery of a bad/corrupted BIOS ROM image via the iDRAC (administrator privilege plus specific firmware, binary, and commands)
LOM Configuration Data	Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable containing the firmware file and the loader. LOMs loaded with arbitrary data in firmware memory would not operate.
iDRAC6 Controller ROM	N/A
iDRAC6 Controller RAM	iDRAC embedded system
System CPLD	Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable (currently only DRMK utility support) containing the firmware file and the loader. System loaded with arbitrary data in CPLD memory would not operate.
System CPLD	Not utilized
iDRAC6 Express Internal Flash	iDRAC OS: Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable containing the firmware file and the loader. System loaded without a good iDRAC firmware image yields a non-functional iDRAC. Managed Services Repository: Various partitions are loaded via vendor-provided firmware file and loader program just like iDRAC OS.
System RAM	System OS
TPM ID EEPROM (Plug in module only)	Factory load only.
TPM Binding EEPROM (on China planar only)	BIOS only
iDRAC6 SDRAM	Embedded iDRAC OS for 108MB and 8MB for VGA frame buffer
iDRAC6 FRU	Factory and iDRAC embedded OS
iDRAC6 Boot Block Flash	Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable or out-of-band firmware updates across the management network. Bad contents yield the iDRAC inoperable and unrecoverable in the customer environment. Note the life cycle log is automatically updated by the iDRAC as various system component FW, HW, and SW verions are changed.
Trusted Platform Module	Using TPM-enabled operating systems
CHIPSET	
CMOS	BIOS control only via input such as BIOS F2 menu user configuration settings (such as boot order)
2.5" BACKPLANE OR 3.5" BACKPLANE	
Storage Controller Processor	Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable (DRMK, USC, OS DUPs utility support) containing the firmware file and the loader. Backplane loaded with bad firmware will not provide backplane and HDD status.
CONTROL PANEL	
Internal USB	Either read-only license key or OS control copies
Internal SD Module	Factory load, OS run time usage, and OS updates and configuration changes.
POWER SUPPLY	
PSU Microcontroller	Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable (Unified Server Configurator) containing the firmware file and the loader. PSUs loaded with bad firmware will not provide PSU functional behavior and result in PSU system faults.
PERC 6/I INTEGRATED	
PERC NVSRAM Config Data	Embedded storage firmware controls this data
PERC Firmware	Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable (DUPs, Unified Server Configurator) containing the firmware file and the loader. Storage adapters loaded with bad firmware will not provide storage controller behavior.
PERC Cache RAM	Embedded storage firmware controls the use of storage cache data.
FRU	Factory only. Not customer updatable.
IBUTTON Key EEPROM	Factory only. Not customer updatable.
CPLD	Factory only. Not customer updatable.
SAS 6/iR Integrated	

R610 Volatility Chart Continued.

	HOW IS DATA INPUT TO THIS MEMORY?
PLANAR, POWEREDGE R610	
Controller Configuration Data	Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable (DUPs, Unified Server Configurator) containing the firmware file and the loader. Storage adapters loaded with bad firmware will not provide storage controller behavior.
FRU	Factory only. Not customer updatable.
Integrated Mirroring NVSRAM	Embedded storage firmware controls this data
iDRAC6 Enterprise	
VFlash	Preloaded media before installation, or remote out-of-band upload of user data (i.e., ISO images, files) or local server read/write capability to use like a hard disk

	HOW IS THIS MEMORY WRITE PROTECTED?	HOW IS THE MEMORY CLEARED?
PLANAR, POWEREDGE R610		
System BIOS SPI Flash	Software write protected	Not possible with any utilities or applications and system is not functional if corrupted/removed.
LOM Configuration Data	Not explicitly protected but special applications are needed to communicate through the LOMs to reprogram this ROM.	Not user clearable
iDRAC6 Controller ROM	Protected permanently by hardware	Not clearable
iDRAC6 Controller RAM	n/a	iDRAC reset
System CPLD	Requires special system-specific utility	Not possible with any utilities or applications and system is not functional if corrupted/removed.
System CPLD	It's not accessible	Not clearable
iDRAC6 Express Internal Flash	Writes are proxied through a temporary iDRAC scratchpad RAM and not directly made from an OS or OS application.	Not user clearable
System RAM	OS control	Reboot or power down system
TPM ID EEPROM (Plug in module only)	HW read only	Not - read only
TPM Binding EEPROM (on China planar only)	Locked by BIOS from physical access by anyone after boot	N/A - BIOS control only
iDRAC6 SDRAM	n/a	AC cycle for BMC OS and reset / power off server for VGA frame buffer
iDRAC6 FRU	Writes controlled by iDRAC embedded OS	EPPID is not clearable
iDRAC6 Boot Block Flash	iDRAC embedded OS control of the write protection.	Not possible with any utilities or applications and iDRAC does not function as expected if corrupted/ removed. Lifecycle log is clearable only in a factory environment. SEL is user clearable.
Trusted Platform Module	SW write protected	F2 setup option
CHIPSET		
CMOS	N/A - BIOS only control	Planar NVRAM_CLR jumper or remove AC cord, remove cover, remove coin cell battery. Wait for 30 seconds, replace battery, cover, and then AC cord. F2 system setup option to restore defaults
2.5" BACKPLANE OR 3.5" BACKPLANE		
Storage Controller Processor	Embedded firmware only writeable through controlled iDRAC methods	Not possible with any utilities or applications and backplane does not function as expected if corrupted/ removed.
CONTROL PANEL		
Internal USB	OS control	OS control format
Internal SD Module	Only by SD card write-protect switch.	OS control format
POWER SUPPLY		
PSU Microcontroller	Protected by the embedded microcontroller. Special keys are used by special vendor-provided utilities to unlock the ROM with various CRC checks during load.	N/A - not in-system clearable

R610 Volatility Chart Continued.

	HOW IS THIS MEMORY WRITE PROTECTED?	HOW IS THE MEMORY CLEARED?
PLANAR, POWEREDGE R610		
PERC 6/I INTEGRATED		
PERC NVSRAM Config Data	Storage controller firmware accessed only	N/A - not in-system clearable
PERC Firmware	Write control access by storage controller firmware	N/A - not in-system clearable
PERC Cache RAM	Storage controller firmware accessed only	Storage controller firmware clearable only. Remove AC AND deplete or remove backup battery.
FRU	Protected in that no iDRAC-embedded firmware writes to this device. Although very convoluted, theoretically, IPMI I^2C Master write commands would flow through to overwrite this EEPROM	N/A - not in-system clearable
IBUTTON Key EEPROM	SHA1 encryption included. Storage controller use only	N/A - not in-system clearable
CPLD	Only factory programmable	N/A - not in-system clearable
SAS 6/iR Integrated		
Controller Configuration Data	Write control access by storage controller firmware	N/A - not in-system clearable
FRU	Protected in that no iDRAC-embedded firmware writes to this device. Although very convoluted, theoretically, IPMI I^2C Master write commands would flow through to overwrite this EEPROM	N/A - not in-system clearable
Integrated Mirroring NVSRAM	Storage controller firmware accessed only	N/A - not in-system clearable
iDRAC6 Enterprise		
VFlash	Media write protection switch or OS control	iDRAC-based format or local OS format or delete or card removal and formatted on a client